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An Address.[1]

THE CHANGING FACE OF MEDICAL PRACTICE IN TASMANIA.

By G. M. W. CLEMONS,

Retiring President of the Tasmanian Branch of the British Medical Association.

IT is the privilege of the retiring president to plague you with an address. I am going to avail myself of this privilege, but I shall be brief.

At the outset, I should like to welcome our new president, Dr. Goddard. He has given long and valuable service to medicine and the public. Although he has ceased private practice and become Director of Tuberculosis in Tasmania, he still has the interests of the profession and the public at heart, and he may in his new position be able to devote still more time to them.

I do not propose to discuss the merits or otherwise of "free" medicine, although I hold very definite views on the subject, but I do wish to draw your attention to certain changes which have taken place in medical practice in recent years.

As a result of the recent *Hospitals Benefits Act*, the means test has been abolished and free treatment is given to all patients in public wards at public hospitals. In Tasmania, although for many years anyone, irrespective of income, could enter a public hospital, very few who could reasonably afford private fees have done so. These hospitals have been staffed very largely by honorary officers who have given their services willingly as is the tradition of the medical profession. Under present conditions it would seem that an increasing number who can afford to pay fees will enter the public hospital.

Should then the honorary system continue? Opinion is not yet unanimous. I believe that the majority would prefer to give their services to those unable to pay, but it is difficult to see how the honorary system can be retained, bearing in mind past Tasmanian history and the circumstances peculiar to Tasmania.

I cannot contemplate the passing of this system without regret, it means the loss of a great tradition.

There is another aspect. In any democratic community, the thought of service to the community should be prominent. Unfortunately only too often one finds the attitude: "What can I get out of this?" Not: "What have I done to deserve it?" If the honorary system passes, this method of service which medical men rendered the community will be lost to them. While some will be able to render service in other fields, the majority will be denied a method of service to which their talents so well fitted them and the community will be the loser; financially, of little importance perhaps, socially, of great importance.

Mention of finance reminds me that a strong reason given for the abolition of the means test is that it removes a stigma from those whose income is below a certain sum. What does it matter if one's income is low, provided one is a decent honest citizen. I should like to add thrifty, but thrift is a quality the Government so discourages as almost to make it a criminal offence. What sense of values is it that places a stigma on the individual with a low income? It is surely the last thing of which to be ashamed. If shame there be, it is certainly not the individual's.

[1] Read at the annual meeting of the Tasmanian Branch of the British Medical Association on March 2, 1946.

The effect on the medical profession of free in-patient treatment in public wards was most immediately felt in country districts, where, in general, there is a small hospital and one practitioner. The Government said, in almost so many words: "Treatment in this hospital is now free. You cannot therefore charge fees for attendance on these patients. We offer you such and such a salary; if you do not accept it we will get another man who will; if we cannot get an Australian, we will get one from elsewhere." The gross injustice of such action needs no emphasis.

Your council at this stage issued a statement in the Press and offered the cooperation of the British Medical Association in arriving at a satisfactory solution. While this elicited a response from the Minister of Health, no satisfactory agreement has yet been reached. In the meantime, individual country practitioners are making the best terms possible, a principle which I consider most undesirable. The council stresses the great importance of maintaining the highest possible standard of medical practice in country districts. The responsibilities of such a practice are great, in some respects greater than those in the large centres where consultations and facilities for all forms of treatment are available. If a good man is prepared to shoulder the difficulties and added responsibilities of a country practice, it is no more than just that he should receive an adequate reward.

In addition to the Commonwealth-wide free in-patient treatment, our State Government has decreed that out-patient treatment shall also be free, with the curious exception that dental attention is still charged for. What effect will this have on the medical profession? It has long been maintained, and I have yet to meet anyone to deny it, that the keystone of good medical service is the family practitioner. If this keystone is removed, the inevitable result must be a rapid decline in good medical service. However spurious this "free" may be, the inevitable result must be that the general public will avail themselves of it. How can general practice be carried on under these conditions? The answer is again obvious—it cannot. How far reaching this loss will be, one can only conjecture. One thing is certain, however, the health of the people will suffer.

At this juncture it may not be out of place to remind you of some of the ways in which government medical services have encroached on private practice in quite recent years. First came the government medical service in country districts. The principle of adequate medical service in remote country districts is recognized and applauded by all. Since its introduction, this service has embraced centres by no means remote. Next came medical service for school children, which includes their treatment, free, in any public hospital with the resulting tendency for these children to drift away from the family practitioner. In fact, if any treatment was advised, parents received a printed notice instructing them to take their children to the nearest public hospital. Incidentally this service was sometimes carried out by a nurse. And now there are free treatment in public wards and free out-patient treatment.

The aggregate of these government services is considerable. What commenced as a gradual process, one of infiltration, is now assuming the proportions of a veritable landslide. Why not free treatment in government owned and subsidized midwifery hospitals? Any hospital with a government subsidy, however small, is now being told that if the subsidy is to continue the hospital must become a public hospital under government control, and of course treatment will be free. If this process continues, as I am sure it is intended to, the inevitable result is that a system of medical service, evolved through the centuries, will be swept aside to be replaced by yet another civil service.

I have friends in the civil service and some experience of civil servants. From discussion and observation I am completely convinced that, apart from the few exceptions which prove the rule, all individual effort and initiative is before long crushed. The service becomes completely impersonal and a mere routine. While I insist that a sound medical service should be available to all, I cannot conceive the best medical service resulting from the type I foresee is being thrust on the public and the medical profession. In saying this, I am fully aware of the defects in the present system.

At the risk of wearying you, I must reiterate some of the dangers which will result from the great increase in out-patient treatment now it is "free". The family practitioner will be one of a dying race. The men who have been the backbone of the medical service will cease to exist. Can they be replaced by out-patient departments, however much they are reorganized? I say emphatically "no". Can young graduates be trained in out-patient departments to take their place? The only way to become a family practitioner is by treating families in their homes or in the privacy of the consulting room.

The next development is not difficult to foretell. The large hospitals will become closed hospitals. The result of this will be a progressive lowering of the standard of medical work outside the hospitals. Therefore the majority of the population will receive treatment either in large out-patient departments, with of course no free choice of doctor, or outside the hospital where the standard of medical practice is low.

I think it is right to say that the bulk of everyday illness is better treated away from hospital. The tendency for the establishment of larger out-patient departments and for hospitalization on the slightest provocation is to be deplored. Hospitals have, of course, a very real and vital part to play in the treatment of the sick, but it is a part only. I say most emphatically that large out-patient departments are one of the worst systems for the treatment of patients.

I believe, too, that the destruction of the family practitioner would have other less obvious but nevertheless important results. Many of the ills and evils of the present day are the direct result of the lack of good family life, and I am sure that the care of the sick in the home, by members of the family, instead of in an impersonal institution, is a potent factor in the promotion of good family life.

The introduction of this system of free out-patient treatment has already had a harmful effect in another direction. At least one highly qualified practitioner has been discouraged from settling in Tasmania and reports from mainland agencies indicate that this is not an isolated example. It is obvious that the standard of medical practice in Tasmania must progressively decline, and so the health of the people will suffer.

What is needed, I suggest, is not bigger and bigger hospitals, but rather better home conditions, a people more conscious of their responsibilities and more good family practitioners. With regard to the latter, the emphasis should be on quality rather than on number.

Let us suppose that I am right in what I am suggesting, namely, that the Government is attempting to change completely the existing type of medical service. What should we do? I submit that we should judge it by two standards: first, will it benefit the health of the community; second, will it benefit the future of medicine? And if having judged on these standards we answer in the negative, as I believe we shall, what then should we do? What can we do? To sit back and accept the change as inevitable is, I suggest, the worst thing we can do. Few things are inevitable if we have the will to resist. We must first approach the Government with a reasoned statement of our objections and endeavour by all possible means to have our views accepted; but if we fail I believe that it is our duty to refuse to take part in a medical service which we believe is harmful to the health of the community and the future of medicine. I believe also that we have a further duty—to see that the defects in our present service are overcome, and if necessary advise and cooperate with the Government in overcoming them.

After six years of war we are now beginning to welcome home a large number of recent graduates who have not practised outside the services. What will their attitude be to these changes in medical practice? Will they desire to continue in government service or to commence private practice? You must remember that many of them will have no intimate knowledge of the good work done by former practitioners, nor of the worth of the men themselves. They will be conscious of changing social conditions and unsettled by life in the armed services. This new type of medical

service may appeal—a sense of security, no great personal responsibility, perhaps regular hours of work, probably a reasonable salary. It would be no great wonder if they accepted it. Should we say the new order has arrived and let them choose for themselves? I think not. They should be made to realize that medicine is not just another job, not just a method of making money, but a profession with a fine tradition and a record of service of which it can be justly proud.

EXPERIMENTAL OBSERVATIONS ON THE AURAL EFFECTS OF GUNBLAST.

By N. E. MURRAY
AND
G. REID,
Captain, Australian Army Medical Corps.

(From the Acoustic Research Laboratory, New Medical School, the University of Sydney.)

THIS paper is an abridged account of work done during the last few years for the Physiological Research Committee (War Problems) of the National Health and Medical Research Council. A detailed account which up to the present has had only a restricted circulation appears elsewhere.[1][2][3]

The investigations consisted of the following:

1. Audiometric measurement of the temporary deafness and recovery in artillerymen exposed in gun-crew positions.
2. Observations on the temporary deafness produced in medical students on exposing them to blast from blank charges in the laboratory. These results, in addition to those under 1 above, gave information on the way deafness develops and recovers, on the influence of number and frequency of blast impulses, on individual variability, and on alteration in sensitivity in individuals.
3. The recording of the blast pressure waves in the various positions of exposure.
4. Correlation of the deafness produced with the blast pressure observations.
5. A survey of a group of artillery personnel and a control group of medical students for the incidence of permanent deafness.
6. Consideration of adequate means of protection against blast.

Historical.

It has long been recognized that many artillerymen and those who are exposed to blast become permanently deaf. The earlier papers have been reviewed by Bunch[4] in 1937. More recently a number of new reports have appeared: Passe[5] (1940), Scott[6] (1940), Davis[7] (1940), Craig[8] (1940), Guild[9] (1941), Alexander[10] (1941), Schilling and Everley[11] (1942), Fox[12] (1943), Suggit[13] (1943), Collins[14] (1944), Taylor[15] (1944), and Silcox and Schenck[16] (1944). Some of these papers are concerned mainly with rupture of the tympanic membrane; indeed when one reviews the literature it appears that a few authors appear unaware of the occurrence of inner ear deafness and regard the detrimental effects of blast largely in terms of ruptured drums.

Bunch[4] (1937) published audiograms of men permanently deafened as a result of exposure to blast from both large guns and small arms. Audiograms of naval or military personnel exposed to blast were also published by Schilling and Everley[11] (1942), by Suggit[13] (1943), and by Taylor[15] (1944). Collins[14] in the Western Desert and Silcox and Schenck[16] at Guadalcanal described the hearing loss due to the effects of blast in battle casualties. These reports, as well as others in the literature, show that, except when the middle ear is damaged by trauma or by subsequent infection, the deafness is of the inner ear type and involves mainly the higher frequencies.

Nearly all the reports on temporary traumatic deafness have been concerned with hearing loss following exposure to continuous noise. Dickson Ewing and Littler[17] (1939) and Campbell and Hargreaves[18] (1940) published audiograms before and after exposure to aeroplane noise. Chamberlain[19] (1942) examined four boilermakers before and after the day's work, and Schilling and Everley[11] (1942) investigated the immediate effect of exposure to Diesel engine noise in submarines. The most comprehensive investigation of this nature was carried out by Hallowell Davis and his fellow workers at Harvard, for the National Defense Research Committee of the United States of America, and was related mainly to problems of the exposure of military personnel to the noise of aeroplanes and armoured fighting vehicles.

Experiments in which subjects have been examined before and after exposure to blast are almost non-existent. Wilson[20] (1942, 1944) described the temporary hearing loss in recruits after their first rifle shooting, but he was mainly concerned with determining whether the deafening effect of a pure tone would be a satisfactory method of predicting susceptibility to gunfire, and Bunch[21] (1938) described the onset of deafness after the explosion of a firecracker.

Scope of Investigation.

Field Observations.—Sixty-four unprotected ears of 35 male subjects of ages ranging from twenty to thirty-eight years were examined before and after firing artillery equipment, small arms and mortars. These subjects, as well as artillerymen, included ourselves (N.E.M. and G.R.). When both ears were not exposed simultaneously, the unexposed ear was protected by an ear plug, Protector Eardrum (Aust.) MK1, used in the Australian Army, and designed by Dr. J. C. Eccles and one of us (N.E.M.). This plug gives a protection of 30 to 40 decibels throughout the range of hearing.

The threshold of hearing of the subjects was tested, before and after exposure, with a Western Electric 6B. audiometer. Subjects whose ears were obstructed with wax were excluded or the wax was removed. In most cases the ear drums were examined, a Rinne test was done, and in a few instances the bone conduction audiometer threshold was determined before and after firing. Unless otherwise stated, the audiogram was taken between ten and twenty minutes after exposure. Sometimes tests were commenced as early as two minutes after exposure, and in a large number of experiments the recovery was followed by a series of audiograms extending over several days. Thresholds were approached from the region heard to the region not heard and the intensities recorded in five decibel steps. Owing to the circumstances in which it was necessary to carry out these field observations, testing could not be done in an acoustic "quiet" room; nevertheless preexposure thresholds were always measured in a particularly quiet environment.

Blast Pressure Measurements.—Records were obtained by means of a Piezo gauge and a cathode ray oscillograph, the tracing being photographed.

Laboratory Experiments.—After preliminary experiments the right ears of twelve subjects were exposed on several occasions three inches in front and nine inches to the side of the muzzle of a 0·303 rifle firing blank charges, the subject facing forward (position A). The blast pressure in this situation was of the order of three to four pounds per square inch. Figure I shows the pressure curve.

Results.

In describing the degree of deafness we have used two criteria. The "peak loss" is the greatest loss at any frequency between 512 and 8,192 cycles per second. The "average" hearing loss is the average loss per octave over a similar range. The first index has an obvious meaning to the reader, for it simply represents the lowest point in the depicted audiogram. The second index is more closely related to the ability to hear speech, and its use facilitates comparison of this work with that of Davis and his co-workers at Harvard.

Figures III and IV show the audiograms of N.E.M. and G.R. respectively at various intervals after exposure.

Figure IV follows exposure to a 17 pounder gun, in a position where the blast pressure is of the order of seven pounds per square inch. Difficulty was experienced in hearing ordinary conversation after this exposure, and it can be seen that recovery was not complete after six days. The exposure here was mild compared with what may be expected in action—seven rounds in four minutes.

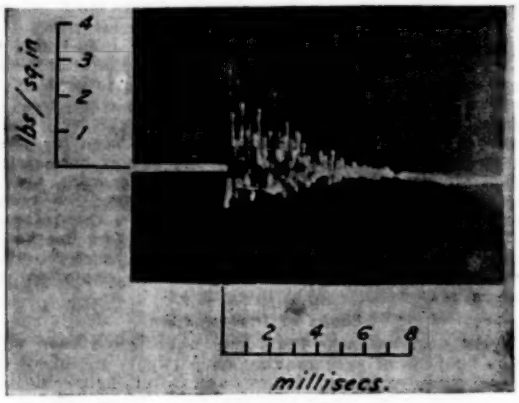

FIGURE I.

As our experience grew we became reluctant to expose subjects unprotected to such large pressures because of the degree of deafness which was caused, and because reports were common of gunners who suffered ruptured ear drums in positions where the blast pressure was probably not greater than this value. Blast pressure measurements in one of the positions for a mortar indicated that the peak blast pressure was of the order of six to eight

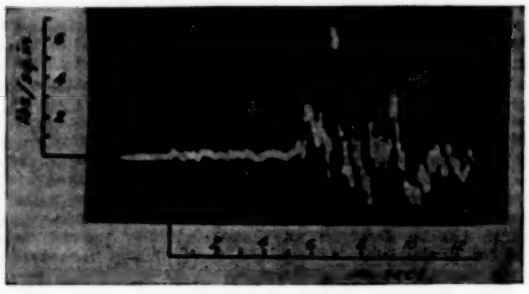

FIGURE II.

pounds per square inch. To minimize possible damage it was decided to expose the right ear of N.E.M. in this position, to fire one round only, and to examine the ear before firing further rounds.

One such round caused considerable pain and severe tinnitus; an audiometric examination begun five minutes later showed a loss of 75 decibels at 4,096 cycles per second (see Figure IIIA). After eighty minutes a second round was fired, bringing the peak loss to 85 decibels at 5,793 cycles per second. There was no further change at 4,096 or 2,048 cycles per second, but a further loss of 10 decibels at 512 and 1,024 cycles per second. This round resulted in rupture of the ear drum with bleeding which may have accounted for the ten decibel increase in the lower frequencies; but it is interesting to note that a Rinne test one, twenty-four and forty-eight hours after exposure gave a positive result with a value of twenty seconds. The type of loudness recruitment which is so characteristic of cochlear deafness was clearly observable in the higher frequencies. In other words, the deafness, in spite of the torn drum, was, in the absence of infection, largely of inner ear origin. Figure IIIB shows the recovery curves from this exposure. The lag in the recovery from the lower frequencies (which usually are the earliest to recover, and do so within a few hours) is probably due to the ruptured ear drum. The loss at 8,192 may now be considered permanent.

Space does not permit a full report of the audiometric findings. Deafness of or greater than that indicated in Figures III and IV was not uncommon. The records of five ears exposed to the 17 pounder gun are set out in Table I. The upper row of figures are those for the audiogram of Figure IV.

Development of Deafness with Successive Rounds.

The statement is frequently made by deafened gunners and was stated in the literature by Passe[3] (1940) that the number of rounds does not seem to matter. Rather, it is a single shot of unexpected severity, or one which catches the subject unawares, which causes the deafness during a shoot.

These laboratory experiments, however, make it clear that a round or a group of rounds, either of which causes little or no damage to the subject in question, may cause a cumulative effect when repeated at suitable intervals.

As Figure V indicates, the average hearing loss for each subject steadily increased (with slight fluctuations) as each round was fired until further shots at the same intervals caused only slight further increases in deafness.

In the experiments used for making Figure V the shots were fired at fifteen minute intervals and the audiometric tests were made between ten and fifteen minutes after each shot.

Variation in Sensitivity in Different Subjects.

A statement commonly made was expressed in words like these: "I never wear ear plugs because the blast never seems to worry me." While many who made such statements did prove on examination to have been deafened, there were also several who, following relatively severe exposures, were scarcely affected. Unfortunately in the field survey many subjects were suffering from considerable permanent or unrecovered deafness before exposure, so that an audiogram showing the loss relative to the subject's preexposure audiogram would be misleading. Moreover, as most of the shoots were carried out for other purposes, it was not possible to standardize rate of fire or gun position.

The variation in susceptibility is therefore more clearly shown in laboratory experiments. Figure V illustrates

TABLE I.

Position and Ear.	Rounds/ Time.	Time After. (Minutes.)	Hearing Loss in Decibels at						
			512 C.P.S.[1]	1,024 C.P.S.	2,048 C.P.S.	4,096 C.P.S.	5,793 C.P.S.	8,192 C.P.S.	9,747 C.P.S.
2R	7/4 m.	15	15	25	40	85	85	75	70
3R	9/7 m.	55	−5	5	0	10	60	60	55
3L	9/7 m.	55	5	0	5	5	15	50	70
4R	9/7 m.	45	0	0	5	20	20	15	15
4L	9/7 m.	45	5	10	25	50	35	65	15

[1] C.P.S. = Cycles per second.

this variation. In addition to the eight subjects whose records have been used in making this figure, there were four others who were extraordinarily insensitive. These were unaffected by ten rounds at ten second intervals, and one of them was unaffected by fifty rounds. There was no evidence that the shape or size of the external auditory canal, and the position of the pinna relative to the head, were important factors in causing such variation, and wax was always excluded.

Decrease in Susceptibility.

It was surprising to find that over periods up to five months no subject for any given exposure exhibited as great a degree of deafness as on the occasion when he was first subjected to it.

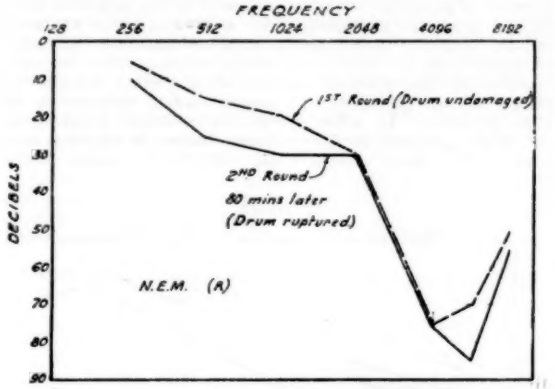

FIG. 3 a. DEAFNESS

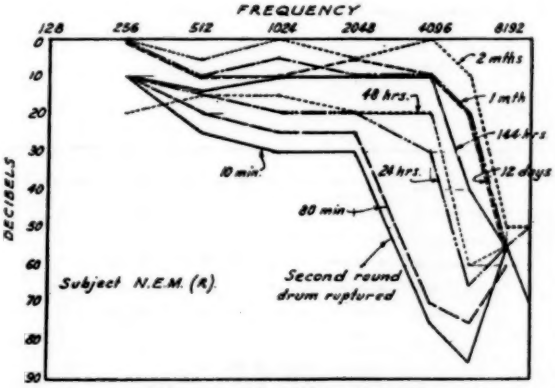

FIG. 3 b. RECOVERY.

FIGURE III.

Ruptured drum. Deafness and recovery from two rounds of three-inch short mortar shells. 0 decibel is the normal preexposure threshold.

Frequencies Affected.

Blast from all kinds of guns affects mainly the higher frequencies. Such differences as were observed depend upon the individual rather than the gun. The peak loss occurred usually between 4,096 and 8,192 cycles per second; sometimes between 2,048 and 4,096, and exceptionally (one subject) between 1,024 and 2,048 cycles per second. The loss beginning at 256 or higher cycles per second may increase to the peak loss over one or more octaves; sometimes it begins very abruptly indeed (see Figure VIII) over a quarter of an octave. Sometimes, but by no means invariably, the loss is interrupted above the peak loss, producing a notched type of audiogram, usually with a further falling away at about 9,747 cycles per second.

Where we watched the development of deafness with successive impulses, it was found that the first effects were recorded mainly at 9,747 cycles per second, sometimes at 4,096 or 5,793 cycles per second, and sometimes in both these regions. Later the effect spreads to involve frequencies above and below those initially affected. Commonly, therefore, there was a lag of several shots before hearing loss became detectable in several of the frequencies.

The Rinne test always gave a positive result with the 512 fork, the result of this test as well as that of the bone conduction audiometer indicating that the deafness is of inner ear or nerve origin. When deafness was produced in ourselves we were able by loudness matching to observe the phenomenon of loudness recruitment which is so characteristic of this kind of deafness (Steinberg and Gardner[20]). Occasionally there was a slight loss of 10 to 15 decibels at 128 or 256 cycles per second unassociated with a great loss in the higher frequencies. This is possibly attributable to the congestion of the ear drum, particularly along the handle of the malleus, which was frequently observed.

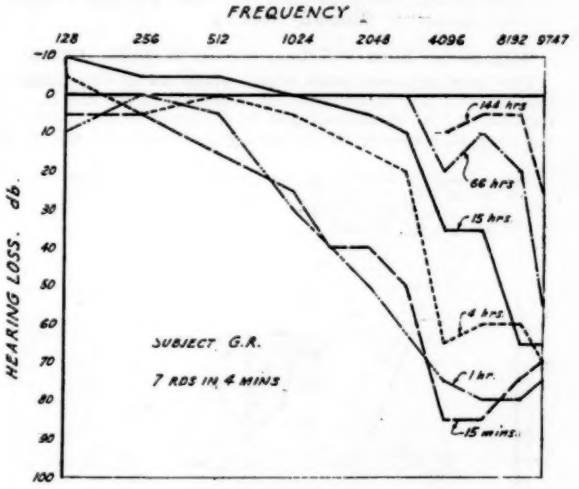

FIGURE IV.

Audiogram at varying periods after exposure to seventeen-pounder T/A gun with muzzle brake. 0 decibel is the pre-exposure threshold.

Recovery.

Figure IV shows the complete audiograms for G.R. at various periods after exposure. In Figure VI the average hearing loss for various subjects has been plotted against time on a logarithmic scale, indicating that recovery follows approximately an exponential curve.

When deafness is severe there may be a lag of several hours before recovery commences in the frequencies most affected. Occasionally the deafness increased for a few hours after exposure before recovery commenced. The last frequency to recover was not necessarily that at which the peak loss occurred and lay in the region 4,096 to 9,747 cycles per second.

Peak losses of the order of 60 to 80 decibels took a week or longer for complete recovery; losses of 30 to 40 decibels recovered usually in twenty-four to forty-eight hours, and peak losses of 20 decibels or less in a few hours.

Onset of Permanent Deafness.

With subject E.P.S. after an exposure which resulted in a peak loss of 40 decibels, hearing in the 4,096 range was still unrecovered two months after exposure. Usually in this subject a loss of this order recovered in less than two days. On this occasion, recovery commenced in the usual way, losses at various intervals after exposure being as shown in Table II.

TABLE II.

Cycles per Second.	Hours after Exposure.							
	0·25	1·0	7·0	23·0	53·0	100·0	104·0	192·0
4,096	40	35	25	25	30	25	20	25
5,793	30	20	10	5	0	0	—	−5
8,192	30	25	20	5	0	0	5	−5
9,747	40	35	25	5	10	10	5	0

It is interesting to note that this considerable lag in recovery did not follow a particularly severe initial deafness; but during the thirteen days before this exposure he had been subjected to seven exposures of the same or less severity, from each of which recovery occurred. This number of experiments was never made in so short a time with other subjects. This unforeseen result indicates that although one very severe exposure may result in permanent damage, it may result from trauma which in the past has led to deafness with recovery, if the insults are repeated for long enough and at suitable intervals. Further evidence on this matter is naturally lacking.

Relation of Blast Pressure Curves to Aural Effects.

The blast pressure wave which produced in one impulse the hearing loss of Figure IIIA is shown in Figure II. In considering the relationship of such curves to aural effects, we have to consider the following features: (*a*) the peak positive pressure; (*b*) the integral pressure by time for the positive impulse; (*c*) the number and frequency of peaks; (*d*) frequencies represented.

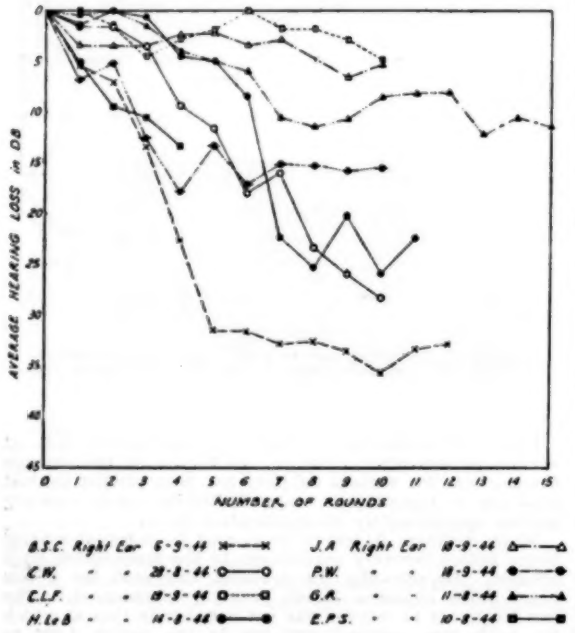
AVERAGE HEARING LOSS in DB
NUMBER OF ROUNDS
B.S.C. Right Ear 6-9-44
C.W. " " 29-8-44
C.L.F. " " 19-9-44
H.LeB " " 14-8-44
J.A Right Ear 18-9-44
P.W. " " 18-9-44
G.R. " " 11-8-44
E.P.S. " " 10-8-44

FIGURE V.

Graph illustrating the effect of number of rounds fired on the average hearing loss (from 512 to 8,192 cycles per second) for eight different ears in eight experiments. Firing at intervals of fifteen minutes, position A (see text).

It was shown earlier that, as the number of impulses in a series increases, hearing loss increases until a stage when further impulses cause only a slight further increase in deafness. The size of the loss at this stage seems to depend mainly on the peak positive pressure of the impulses. Attempts to be more precise for a number of subjects were not successful because of individual variation, and because in the field the rate and number of rounds and gun-position were not standardized. Likewise the results gave no direct information on the influence of number of peaks or frequencies found in the pressure wave, on the deafness produced; but there was little variation in these factors. Nevertheless sufficient data were obtained to show, from the records of single subjects, that the chief feature of the pressure waves which came within the range of our experience in causing aural damage is the peak pressure. In other words, other things being equal, the peak pressure is the deciding factor in causing deafness. The blast effects from individual rounds varies considerably, so that for any quantitative guide the exposure should be to a number of rounds: ten rounds is most suitable for these pressures, giving what may be termed the "ten round hearing loss". From the full data of variations in hearing loss for different subjects for the same exposure, some of which is shown in Figure V, one of us (G.R.) was found to be of approximately average sensitivity. Data were also obtained for G.R. over a range of measured field pressures from 1·8 to 7·0 pounds per square inch for approximately ten rounds and is plotted in Figure VII.

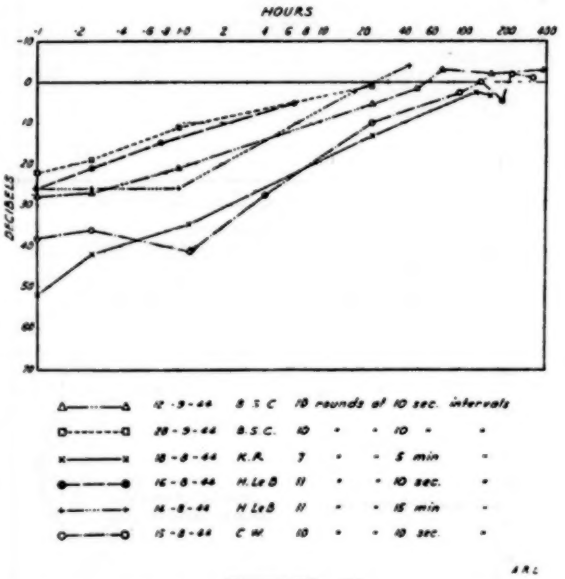
HOURS
DECIBELS
12-9-44 B.S.C. 10 rounds at 10 sec. intervals
28-9-44 B.S.C. 10 " " 10 " "
18-8-44 K.R. 7 " " 5 min "
16-8-44 H.LeB 11 " " 10 sec. "
14-8-44 H LeB 11 " " 15 min "
15-8-44 C.W. 10 " " 10 sec. "

FIGURE VI.

Recovery curves of hearing loss over range 512 to 8,192 cycles per second after exposure to blank rounds from rifle, position A.

Otological "Safe" Limits.

Our observations on peak pressures enabled us to make the following tabulation.

Protection is desirable at all pressures, but is essential for pressures above one and a half pounds. With pressures of one and a half to four pounds per square inch

peak losses up to 60 to 70 decibels will commonly occur after ten to twenty rounds, and with pressures in the range four to eight pounds per square inch protection is imperative to prevent rupture of the drum in some cases and peak losses of 80 or more decibels after as few as one or two rounds.

In our experience pressures as low as 0·25 pound per square inch commonly caused peak hearing losses of 40 decibels or more after 100 or more shots. This is the pressure produced at the ear when a 0·303 rifle is fired from the hip or shoulder.

Incidence of Permanent Deafness in Artillerymen.

It is proposed to give the results of our investigation of the incidence of permanent deafness in artillerymen in greater detail at a future date. It suffices to state here that audiometric examination of 116 artillerymen, without present evidence or past history of torn drums or middle ear involvement, showed that 50% had peak losses in the worse ear of or greater than 30 decibels and 23% had peak losses greater than 50 decibels. The mean average loss of the group was 10·2 decibels, the corresponding figure for 103 medical students being 0·52 decibel. This difference is highly significant and is not attributable to a difference in age.

The various shapes of audiogram met with in subjects with permanent deafness were to be found in the study of temporary deafness. This is seen by comparing the corresponding panels in Figures VIII and IX.

Means of Protection.

Means of protection also will be discussed fully later. It was shown by exposing subjects to gunblast of the order of four to six pounds per square inch that cotton wool is an inadequate form of ear protection (see Figure VIIID). Tested with pure tones in the laboratory, it was

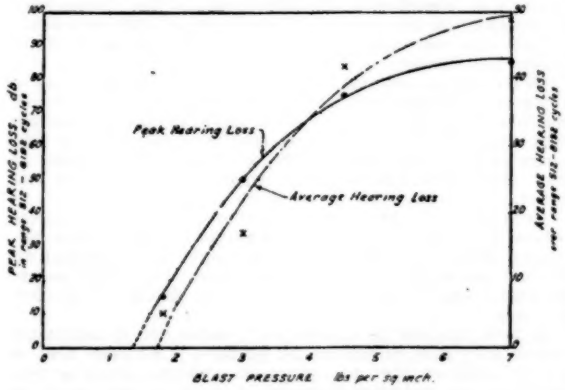

FIGURE VII.

Blast pressures *versus* hearing loss. Subject of average sensitivity. Effect of ten rounds at short intervals. ("Ten round hearing loss".)

also found that cotton wool properly inserted attenuated sound only by 10 to 15 decibels at high frequencies and scarcely at all at low frequencies. On the other hand, a closely fitting plug of synthetic rubber (the one referred to earlier) gave protection throughout the hearing range of 30 to 40 decibels. Tested in the ears of subjects exposed to the same gunblast as that referred to above, full protection was given from 250 rounds.

There is considerable evidence going back at least as far as the first world war that cotton wool is a most inadequate form of ear protection.[9][15] It is regrettable that this aspect of preventive medicine has been so neglected by the otologist both here and abroad, for it is not merely a matter of wartime interest, but an important consideration in industrial medicine.

General Discussion.

Practical Hearing Capacity of Deaf Subjects.

The figures given and the audiograms drawn represent threshold hearing losses. Thus a threshold loss of, say, 30 decibels at a frequency of 2,048, means that a tone of that frequency which was just heard by the subject's normal ear must be raised 30 decibels in order to be just heard in the ear made deaf, that is, its energy value must be increased 1,000 times.

Now it is characteristic of the way loudness is recruited in this type of deafness that the loss of perceived loudness

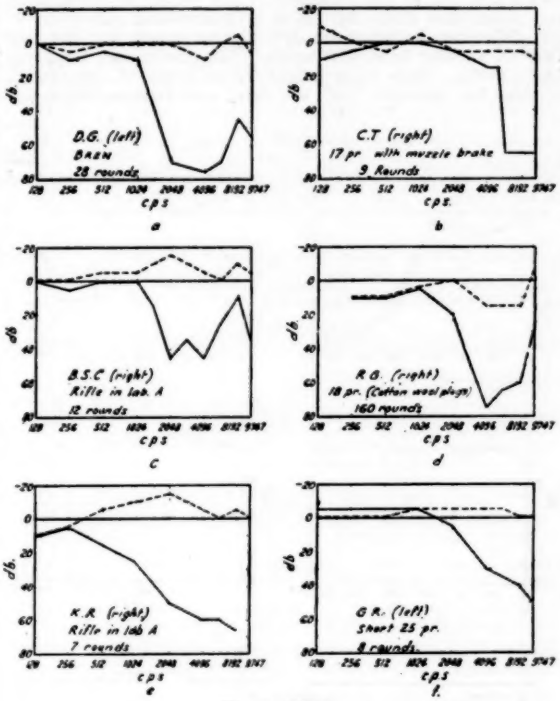

FIGURE VIII.

Audiograms of subjects showing temporary deafness after exposure to gunfire. Before exposure, - - - - - - - -; after exposure, ————.

is not constant, but diminishes as the intensity of the sound is increased. Consider, for example, a normal and a deaf ear differing in acuity at threshold by a given number of decibels, say, 30. With sounds at the level of ordinary speech (60 to 70 decibels) the difference in the sensations of loudness between the two ears may be considerably reduced from this difference at threshold, and reduced even more so at the level of noise in aeroplanes, tanks or workshops. The extent to which this occurs will depend on the size of the threshold loss.

The deafness due to gunblast may be of importance, then, in: (*a*) affecting the ability to hear sounds near threshold, or (*b*) affecting the ability to hear speech at various levels of intensity. As pointed out above, the first of these effects is greater than the second, and it must be added that in civil life threshold hearing is not usually of great importance. In warfare, when an enemy may betray his presence by the least noise, threshold hearing becomes of the greatest importance, especially as many of the sounds a sentry must detect contain a lot of high frequency components, for example, the rustle of leaves. With many of the hearing losses we have recorded the subjects would be impaired as sentries for several days.

Another point requires emphasis. Usually one ear is more affected than the other. This means that not only

will a subject have a threshold hearing loss, but his localization of sounds may be seriously impaired.

So far as the ability to understand speech is concerned, much of the hearing loss, particularly when the effects of gunblast were slight, lies outside the range which is of chief importance for the hearing of speech. When the exposure is severe, as in Figures III and IV, the speech range is involved.

How does the way in which loudness is recruited, as described above, affect the hearing of speech in deafness of the type under consideration? A rapid decrease in the difference between the loudnesses perceived by a normal and a deaf ear as the intensity of the source is raised does not mean that there will be a corresponding reduction in the difference between the articulation scores for the two ears at various intensity levels. (Steinberg and Gardner, 1937, 1940.) This is largely because some of the speech sounds, for example, "th", are faint and remain below the

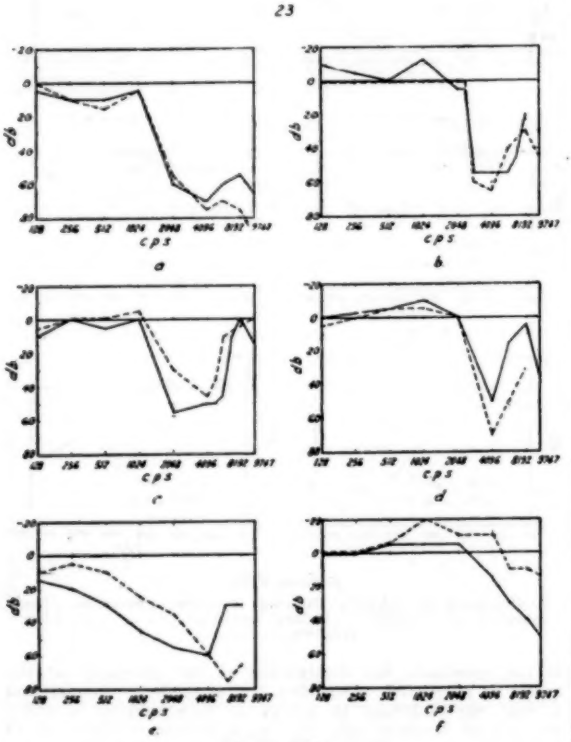

FIGURE IX.

Audiograms of six subjects with permanent gunfire deafness. Left ear, ————; right ear, - - - - - - -.

threshold of the deaf ear. Davis *et alii* investigated the articulation efficiency of subjects during the temporary deafness after exposure to noise, and found in subjects with hearing losses comparable to the worst of our own, moderately large articulation losses at the 40 and 70 decibel level, but because of the wide scatter of the points, no quantitative relation between hearing loss and articulation loss could be established. Articulation loss at the 100 decibel level was never severe.

Practically, the effect on hearing of conversation at the ordinary speech level of 60 to 70 decibels may be summarized as follows. When loss is as severe as obtained after firing the 17 pounder there will be considerable impairment of hearing of speech, whereas with mild losses the impairment of hearing at ordinary speech levels may be slight and the subject not appear obviously deaf to his fellows.

These facts have a bearing on the question of protection and the way orders are given to gun crews. If the drill is such that orders reach the members of a gun crew at, say, 60 decibels, then if plugs are worn, naturally there will be a difficulty in hearing them. On the other hand, without plugs, there will be a loss of hearing due to gunblast, which, at that level of intensity, will of itself impair the hearing of orders. If the wearing of plugs is part of the normal gun drill, then it should be possible to transmit orders so that they will be properly heard, despite the overall 30 decibel loss which a good plug gives. This loss, moreover, will remain constant over a period of action.

We have observed also that when the ears are properly protected, the gunner's attention and activity are no longer directed towards protecting his ears—by raising his hands, by tilting his head or by other tricks. For these reasons we consider that the wearing of comfortable plugs not only prevents hearing loss, but improves the general efficiency of the gunner.

Relationship of Deafness to Trauma.

It has been stated (Suggit, 1943) that "abrupt" high tone loss characterizes the deafness caused by a single explosion, whereas the "gradual" loss with increase in frequency characterizes that due to slight concussions in series over a long period. We do not think it is possible to make so rigid an assertion. Bunch (1937) is probably nearer the truth when he states: "This differentiation between 'abrupt' and 'gradual' cannot be carried to the extreme, but the terms are quite descriptive."

It is quite reasonable to consider that a single severe concussion may cause a local hæmorrhage into the cochlea, resulting in an abrupt loss of hearing. In fact local severe damage of this nature may be responsible for the permanent loss of hearing at 8,192 cycles per second in the audiogram of N.E.M. (Figure III). This resulted after two rounds of a mortar producing pressures of the order of six to eight pounds per square inch. At the same time there was considerable hearing loss in the frequencies below this; in fact the temporary loss at 4,096 cycles per second was even greater than the permanent loss of 8,192 cycles per second.

Nevertheless, abrupt high tone loss does occur as a temporary phenomenon. Many of our curves of temporary deafness resemble those curves showing abrupt hearing loss reported by Suggit, but they are not sharply distinguishable from curves with "gradual" hearing loss; in fact, there seems to be every gradation between the two types.

Gradual high tone loss has been found in subjects whose deafness resulted from a single trauma. Likewise, abrupt high tone loss has been found as a permanent feature in subjects who give no history of a single severe trauma; some of these are surprised to discover that they are deaf.

It now remains to discuss the possible set of conditions which may lead to permanent deafness. We have first of all to consider that a trauma of sufficient severity will produce, not only involvement of cells in the organ of Corti by direct action, but will cause vascular damage resulting in hæmorrhage. It is this type which, when localized, one would expect to lead to an "abrupt" loss of hearing and may, as Suggit suggests, follow a single severe trauma. The fact that it occurs as a temporary phenomenon after a series of traumata of less severity suggests that the "abrupt" loss may also be related to a particular "pattern of damage" on the basilar membrane. The general pattern appears to vary from individual to individual.

Secondly, we have to consider, as foreshadowed in the previous paragraph, that trauma may damage cells in the organ of Corti without vascular lesion. This may result from a single shock or from shocks sufficiently often and rapidly repeated. The deafness so produced will, whether temporary or permanent, depend on a "pattern" of damage of the cochlea and may be "gradual" or "abrupt". The question arises: In what circumstances do repeated exposures lead to permanent deafness? Will clinical recovery between exposures prevent a cumulative effect?

It must be borne in mind that clinical recovery means no detectable deafness; it may not mean that the organ of Corti has returned to normal. Sometimes, indeed, there appears to be a phase of supranormal excitability. Again, in following the development of deafness with successive rounds, we found the initial blasts to be without effect on the hearing at certain frequencies; but as further shots of the same severity were fired, deafness would appear at these frequencies. In other words, some latent damage had been produced by the earlier blasts rendering the organ of Corti more susceptible to subsequent blasts with manifest damage.

In this respect the unrecovered deafness of subject E.P.S. is suggestive. Here there was no question of a single exceptionally severe trauma, but a series of minor insults, recovery from each one, with the exception of the last, having taken place. When trauma is repeated without recovery clinically, probably permanent deafness is even more likely to ensue.

With permanent deafness due to noise, again, there is no question of a single severe trauma, but a series of repeated insults producing an audiogram representing a "pattern of damage" peculiar to the individual. Such subjects as well as gunners are being repeatedly reexposed during periods of unrecovered deafness.

Another aspect of a more general nature remains for discussion. It appears that nervous tissue (possibly other tissue also) responds to very rapid physical stress with loss of function. This phenomenon is seen classically in the very rapid physical stresses producing concussion either of nerve or brain. It occurs independently of vascular damage, although, of course, if the stress is severe enough, vascular damage can and does occur. In considering the temporary deafness following exposure to a single blast wave, we are probably dealing with the same fundamental problem—in this case involving the organ of Corti. What then is the nature of temporary deafness following repeated traumata, each in itself insufficient to produce measureable change? Probably this is the same fundamentally. It is interesting to note that concussion has been produced experimentally, not only with a single blow, but with repeated blows. Thus Koch and Filene and Polis[32] showed that an animal could be killed by a series of light blows without hæmorrhagic lesions.

In this connexion it is interesting to note that, following exposure to blast, not only was temporary deafness experienced, but also subjective numbness at the side of the face, particularly in the external auditory canal.

Summary.

1. Subjects were exposed to gunblast in the field and, under more controlled conditions, in the laboratory.

2. Exposure to gunblast which is not of sufficient severity to rupture the ear drums causes inner-ear deafness which affects mainly the higher frequencies, but may, with repeated impulses, extend as low as 256 cycles per second.

3. The magnitude of the exposure necessary to produce a given degree of hearing loss varies with the individual; but severe effects (that is, with peak losses of from 55 to 85 decibels) were commonly caused by exposures which were mild compared with what may be expected in action.

4. Measurement of blast pressure in gun crew positions indicated that, other things being equal, the loss runs parallel, roughly, with peak blast pressure.

5. Rupture of the ear drum occurred in one subject exposed to a blast pressure of six to eight pounds per square inch.

6. Loss of hearing lasted from a few hours to several days.

7. Cotton wool plugs are an inadequate form of ear protection.

8. Audiometric examination of artillerymen showed that of 116 men without evidence of middle ear involvement, 50% had peak losses in the worse ear greater than 30 decibels. The mean average hearing loss of the group was 10·2 decibels. The corresponding figure for a group of 103 medical students was 0·52 decibel. This difference is highly significant.

9. All the types of audiogram met with in the study of permanent deafness were observed during the study of temporary deafness.

10. The significance of deafness due to blast and the mode of onset of permanent deafness are discussed.

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THE VALUE OF BIOCHEMICAL TESTS IN THE INTERPRETATION OF JAUNDICE.

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FOR the past fifteen years it has been possible to observe the correlation of the results of biochemical tests carried out in this institute with the clinical differential diagnosis of jaundice. Since many misconceptions still persist concerning the value of the various tests, it seems opportune to record our experiences and opinions.

The Van den Bergh Reaction.

The Van den Bergh reaction is designed to determine quantitative and qualitative changes in serum bilirubin.

Theoretical Considerations.

From studies on the blood pigments in jaundice, and by noting the reactions to Ehrlich's diazo reagent, Van den Bergh demonstrated that two types of pigment existed. These have been termed the direct and indirect reacting

pigments respectively. According to Van den Bergh, the blood bilirubin in obstructive jaundice is in the free state and couples directly with Ehrlich's diazo reagent (diazobenzene-*p*-sulphonic acid), whereas in hæmolytic jaundice the pigment, not having passed through the polygonal liver cells, is in combination with protein, from which it must be liberated by alcohol before coupling will occur with the diazo reagent (indirect reaction). Other workers have been unable to demonstrate a bilirubin-protein combination, but nevertheless the fact remains that two types of pigment undoubtedly exist. Griffiths[1] has isolated a pigment from gall-bladder bile which gives a direct reaction to the Van den Bergh test. It is a separate entity from bilirubin and has been termed cholebilirubin. The properties of this pigment are those associated with the direct reacting pigment of obstructive jaundice.

Further, it has been shown that bilirubin is responsible for the indirect reaction.

In the direct Van den Bergh test, in which the serum is added, without modification to the diazo-reagent, three types of response are described—namely, immediate direct, delayed direct and biphasic. The following are the conventional interpretations of these reactions.

In uncomplicated obstructive jaundice a prompt direct reaction is obtained. The biphasic reaction occurs in jaundice due to toxic or infective hepatitis; it is said to be due to a mixture of direct and indirect reacting pigments. The hepatic cells are damaged, and so are not able to pass on the bilirubin which reaches them. This accumulates in the blood and gives the indirect or delayed direct reaction. Some bile which does pass into the bile ducts finds these blocked by mucus, and an obstructive element is introduced.

The delayed direct reaction is said to occur in hæmolytic jaundice—that is, in acholuric jaundice, pernicious anæmia, *et cetera*. In these conditions, owing to an excessive destruction of the red cells, the amount of bilirubin brought to the polygonal cells of the liver is greater than can be immediately dealt with, and it accumulates in the circulation. This pigment is therefore of the same type as that normally existing in the blood.

The above, then, are the theoretical considerations, and it now becomes pertinent to inquire as to how these agree with the clinical findings. From the findings in this laboratory we are in accord with the view that in the presence of obstruction of whatever cause—stone, enlarged portal glands, pancreatic neoplasm *et cetera*—a direct Van den Bergh reaction is obtained.

Comment.

The interpretation of the biphasic reaction, however, cannot be made according to theoretical conceptions, as practically without exception in all the cases of hepatitis examined within the first seven days after the onset of jaundice, a prompt direct Van den Bergh reaction was obtained. This has also been the experience of other workers. Havens,[2] reviewing an outbreak of infectious hepatitis in the Middle East, found that in 60 cases in which the Van den Bergh test was carried out, the response was a prompt direct reaction in all but three instances. The determinations were made within the first five days of the jaundice. Again Finkes and Blumberg,[3] from studies on 255 patients suffering from epidemic hepatitis in a combat zone, found that during the first two weeks a direct Van den Bergh reaction was obtained in over one-third of the cases. In the remainder biphasic responses were obtained; but what is extremely puzzling is that during the period of convalescence in most cases the indirect reaction was elicited. Apart from these inconsistencies concerning interpretation of the Van den Bergh reaction, there is evidence that the various types of direct reaction depend not so much on the nature of the hepatic disturbance as on the concentration of bile pigment in the serum. From photoelectric studies of the direct Van den Bergh reaction, Gray and Whidborne[4] found that Beer's law is not followed with concentrations of azopigment corresponding to more than 1·6 milligrammes of bilirubin *per centum*. It is considered that serum containing high concentrations of bilirubin will give the direct reaction, no matter whether the jaundice is of an obstructive nature or due to hepatitis. These findings confirm those of Stein,[5] who originally suggested that the type of direct Van den Bergh reaction depended solely on the concentration of bilirubin in the serum. Further, it has been shown that when serum giving a prompt direct Van den Bergh reaction is diluted with normal serum, the direct reaction becomes biphasic or delayed according to the degree of the dilution.

This last finding is in accord with our own observations—namely, that when there is a sufficiently high concentration of bilirubin in the serum, the Van den Bergh reaction is always prompt, direct, irrespective of the nature of the jaundice. This applies to hæmolytic jaundice, in which one would expect only the indirect reaction to be obtained. In three cases of familial acholuric jaundice that came under observation a direct Van den Bergh reaction was obtained. This is in accord with the observations of Harrison.[6] Hence, as the qualitative Van den Bergh test is based on unsound biochemical and physiological premises, it cannot be expected to yield accurate information to the clinician. By means of the indirect reaction, it is possible to estimate quantitatively the bilirubin content of serum, and this is of value when latent icterus occurs as in pernicious anæmia or in the preicteric stage of hepatitis. The normal content of bilirubin in human serum varies from 0·2 to 0·5 Van den Bergh unit (0·1 to 0·25 milligramme *per centum*). The extreme upper level is stated to be one unit (0·5 milligramme *per centum*).

Fouchet's reaction test will detect a serum bilirubin concentration of 3·5 units (1·75 milligrammes *per centum*), and although it is less sensitive than the Van den Bergh reaction it is frequently used as a test for latent jaundice.

It would therefore appear that the sole practical value of the Van den Bergh test is for the determination of latent jaundice. It might be argued that progressive quantitative serum bilirubin estimations would be of value, for example, after operation in cases of obstructive jaundice or to follow the course of hepatitis. In the former, such estimations would be of academic interest and would not usually be required by the surgeon to determine whether the obstruction had been relieved. If the estimation was relied upon in order to determine whether hepatitis had completely subsided and the patient could be discharged from hospital, grave errors of judgement might be made.

From observations on epidemic hepatitis in the army, it has been noted that there is no definite correlation between the degree of icterus and the severity of symptoms. Furthermore, in such cases when the serum bilirubin level has returned practically to normal and the patient feels well, severe relapses may occur, if he is discharged from hospital. In such cases even mild exercise may precipitate a relapse.[7] Hangar's flocculation test, as will be discussed later, should be relied upon to determine when parenchymatous damage is no longer present.

The foregoing may appear a somewhat sweeping condemnation of a test that is still considered by some practitioners as of diagnostic value. The opinions stated have been arrived at after the most careful consideration of experiences over many years. In a recent lecture to students in their final year of the medical course, the above views were expressed. It was somewhat embarrassing some days later when one of them, obviously very perplexed, asked what he should say if asked to discuss the Van den Bergh reaction in his final examination. Apparently his "honorary", in dealing with a case of jaundice, had had our views communicated to him, and the student was informed that despite what the laboratory stated, he (the "honorary") found the test of great value in the differential diagnosis of jaundice.

Urobilin and Urobilinogen.

In order to appreciate the significance of variations in the amounts of urobilin and urobilinogen that are excreted in jaundice, it is necessary to review briefly the cycle of bilirubin. In the intestine bilirubin is reduced by bacteria to stercobilinogen, the main amount of which is excreted

in the fæces. A small portion is absorbed into the blood stream and passes to the liver, where it is reexcreted into the bile. Apart from this, some stercobilinogen is excreted into the urine as urobilinogen, which chromogen is probably identical with stercobilinogen. When the urine is exposed to air and light urobilinogen is oxidized to urobilin.

Urobilinogen, but not urobilin, gives Ehrlich's reaction with *p*-dimethyl-aminobenzaldehyde. In Schlesinger's reaction, a fluorescent zinc-urobilin is formed. The test can be used to detect increased excretion of both urobilinogen and urobilin, since any urobilinogen present is oxidized to urobilin.

Of all the bile pigments that come under biochemical investigation, urobilinogen is, in our opinion, the only one that offers any help in differential diagnosis. From consideration of the bile cycle, it is apparent that the presence of urobilinogen in the urine is dependent upon bile entering the intestine. Hence, in jaundice due to complete biliary obstruction, one would expect to find bile pigments and salts in the urine, but no excess of urobilinogen. In hepatitis, in which the function of the polygonal cells in respect of reexcretion of stercobilinogen into the bile is impaired, or in which an excessive amount of bilirubin is brought to the liver as in hæmolytic jaundice, an increased excretion of urinary urobilinogen will be found.

From the practical standpoint useful information may be considered under two main headings: (i) jaundice without an increased output of urinary urobilinogen, (ii) increased urinary urobilinogen with or without jaundice.

In simple mechanical obstruction of the common duct, the urinary findings are a great increase of bile pigments and salts, but no excess of urobilinogen. In liver damage, as in infective or toxic hepatitis, the capacity of the polygonal cells to reexcrete urobilinogen is diminished, and the excess of this pigment which accumulates in the blood escapes into the urine. In the preicteric stage of hepatitis, when diagnosis may be difficult, it is usually possible to demonstrate an increased excretion of urobilinogen. Some workers suggest that by following the urobilinogen excretion during the course of hepatitis it is possible to determine when liver function has returned to normal. Perhaps from this aspect the test may be too sensitive, since Hayman and Reed,[8] in a study of 220 cases of jaundice following yellow fever vaccination, noted that the result of the cephalin-cholesterol flocculation test became negative before urobilinogen excretion returned to normal.

Again, it is common to find increased amounts of urobilinogen in the urine, in mild disturbance of hepatic function—for example, after the ingestion of alcohol. Positive results may also be obtained in febrile states. However, despite this, if the results are interpreted in association with that of Hanger's test and the serum alkaline phospatase level (see later), considerable aid to the diagnosis of the condition is obtained.

When, owing to abnormal red cell destruction causing an increase in the serum bilirubin content and hence the formation of larger amounts of stercobilinogen in the intestine, the liver is unable to reexcrete completely the excess of urobilinogen brought to it, a positive result to Schlesinger's test will be obtained from the urine. This will occur in pernicious anæmia and in familial acholuric jaundice.

Alkaline Serum Phosphatase.

Phosphates are enzymes capable of hydrolysing various phosphoric esters, such as hexosephosphates, glycerophosphate *et cetera*. Two forms exist in the body, one the alkaline form, with an optimum activity at about pH 9·0, and an acid form, with optimum activity at pH 5·0. Bone is the richest source of the alkaline form, whilst prostatic tissue contains considerable amounts of the acid type. Normally in serum the alkaline phosphatase predominates and is believed to be excreted into the bile. Hence in biliary obstruction one would expect to find increased phosphatase activity.

The Cephalin-Cholesterol Flocculation Test.

The cephalin-cholesterol flocculation test was originally described by Hanger[9] in 1939, and consists in the mixing of the patient's serum with a cephalin-cholesterol emulsion. If flocculation occurs within forty-eight hours, it is assumed that active parenchymal disease of the liver exists. The test is therefore of value in distinguishing jaundice due to hepatitis from that due to biliary obstruction. A positive result is usually obtained in the early stages of hepatitis with acute symptoms. Furthermore, information can be obtained as to when parenchymal disease has ceased and whether the patient is fit to be discharged from hospital.

In carrying out the test there is one precaution to be observed if reliable results are to be obtained, and that is that the cephalin from which the emulsion is prepared must be aged from four to six weeks.

During a recent outbreak of hepatitis following yellow fever vaccination, 341 flocculation tests were performed on 147 patients. Mr. Doutch, of this institute, who collaborated in this work, found that in the preliminary tests made with emulsions from freshly prepared cephalin, positive results were obtained with normal serum. Accidentally it was found that in order to obtain the correct sensitivity the cephalin had to be aged. This point was later noted by other workers, but is not remarked upon in the original description by Hanger.

Discussion.

In Table I the findings in various types of jaundice are set out.

TABLE I.
Biochemical Findings in Jaundice.

Type of Jaundice.	Urinary Urobilinogen.	Urinary Bile Pigments and Salts.	Result of Hanger's Test.	Alkaline Serum Phosphatase.
Obstructive without associated liver damage.	Not increased.	Increased.	Negative.	Increased.
Toxic and infective hepatitis	Increased.	Often increased.	Positive.	Not increased.
Hæmolytic	Increased.	Not increased.	Negative, or faintly positive.	Not increased.

It must be realized that although no single test is invariably diagnostic of any particular type of jaundice, yet appropriate combinations materially assist in diagnosis. This particularly applies to estimations of serum phosphatase and to Hanger's flocculation test. Gutman and Hanger's findings[10] support this contention. In 73 cases of proven obstructive jaundice, there would have been disagreement with the proved diagnosis in 12 cases if reliance had been placed upon the serum phosphatase level alone. If only the results of the flocculation test had been considered, there would have been disagreement in six instances. If the results of both tests were considered in all cases, there would have been 100% agreement with the proven diagnosis. Similarly, of 66 cases of catarrhal jaundice, 12 would not have been regarded as such from the results of the serum phosphatase estimation. In six cases only a faintly positive result was obtained to the flocculation test. Again, however, if the results of both tests were taken into consideration there was no discrepancy with the diagnosis.

In general it can be stated that a result of a flocculation test giving a reading of more than one *plus* (+) indicates catarrhal jaundice; on the other hand, a reading of less than two *plus* (++) indicates obstructive jaundice.

Conclusions.

1. The qualitative Van den Bergh reaction is of no diagnostic value in the differential diagnosis of jaundice. The quantitative test can be used for the detection of latent jaundice.

2. If their results are considered together the serum alkaline phosphatase estimation and the flocculation test afford aid in the differentiation between obstructive jaundice and jaundice due to hepatitis.

3. The flocculation test gives information as to when parenchymal damage has ceased.

4. Estimations of urobilinogen excretion afford contributory evidence to that obtained by other tests. Increased excretion is found in hepatitis and hæmolytic anæmia.

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MEDICAL REHABILITATION: ITS ORGANIZATION IN THE ROYAL AIR FORCE AND THE ROYAL AUSTRALIAN AIR FORCE.

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THE word "rehabilitation" is heard on all sides these days, and it is used in many senses. The word is defined in "The Oxford English Dictionary" as "the restoration to privileges". In the medical sense this would signify restoration to privileges of health so far as this is possible.

It is the aim of all doctors and nurses to restore their patients to the privileges of health, and therefore it may be argued that there is nothing new in rehabilitation. When we are considering acute illnesses from which recovery is rapid and complete, this argument is true; but when we are considering subacute and chronic disease or disability, there have been many instances in which the patient's treatment has not been fully completed. This has not been due to lack of care on the part of the surgeon or physician or the nurse, but rather has it been due to lack of the full appreciation of all the problems that assail the chronically disabled.

With the increase in knowledge of human physiological and anatomical function and of the response of the body to disease and injury, there is a natural development of more specialized medicine and surgery, and with this increased specialism there is a tendency for the doctor to think more in terms of an injured body rather than of a diseased or injured person.

The general practitioner, coming as he does into intimate contact with the family unit, has had to face and help solve the many problems of a social nature which result from sickness or injury. He has, perhaps, referred his patients to specialists for their expert opinion or for expert surgical or medical treatment; but at the conclusion of this treatment the family doctor has assumed the responsibility of assisting any necessary social or mental readjustments. Whereas the specialist has dealt with the body impersonally, the family doctor has dealt with the person. The development of medical rehabilitation may be regarded as a natural consequence of increased specialism, and it demonstrates a more general appreciation by the medical profession of its responsibilities for the convalescence of all patients, and the formal recognition of the part which a patient's personality plays in his readjustments after injury or disease.

True medical rehabilitation, as one writer states, "begins in the ambulance", and continues throughout the hospital and post-hospital period until maximum recovery is attained and the person concerned is back in his old employment or in a new employment suited to his capabilities. In other words, his rehabilitation has begun with the surgeon and ended with the employer, and has been effected through the combined team work of the surgeon or physician, the nurse, the physiotherapist, the occupational therapist, the physical training instructor, the man's own relatives, the social worker and the employer. It has depended on good medical or surgical treatment backed up by sound psychology. Above all, however, it has depended on the continued interest of the surgeon or physician who has never forgotten that his patient is a person, a member of the community who must return to that community at the completion of his treatment and become once more a happy and useful member.

HISTORY OF DEVELOPMENT.

The development of medical rehabilitation services for the chronically disabled has been most clearly demonstrated in England. Rehabilitation was first officially adopted there in the war of 1914 to 1918 by the provision of special "fracture wards" in military hospitals, and of "command depots", each of the latter accommodating as many as 5,000 persons. This organization was purely a wartime measure adopted to aid rapid return to duty of wounded men. The institutions did not survive that war, and any lesson that was learnt then was soon forgotten.

Most civilian hospitals continued to discharge their patients directly to their homes, with perhaps one or two attendances at an out-patient department. For orthopædic and fracture cases there were, of course, physiotherapy departments, at which patients attended for treatment two or three times a week. More frequently such patients were left to their own devices, to become, in their ignorance, so-called "chronic invalids". In most cases after discharge from hospital there was very little supervision by the surgeon or physician during this convalescent period, even though recovery was far from complete, and there was little if any provision for the resettlement of the permanently disabled.

The pioneer work in Great Britain after the war of 1914-1918 in establishing special centres for the rehabilitation of persons suffering from physical injury, was carried out at Crewe, England, under H. E. Moore, who treated employees of the London, Midland and Scottish Railway Company. A little later, Mr. A. Miller organized a clinic at Motherwell, near Glasgow, for the sociological as well as the physical rehabilitation of miners.

In England, however, there was a growing appreciation of the necessity for facilities for the treatment of chronic disabilities, and in 1935, a British Medical Association committee on fractures recommended the establishment of rehabilitation centres for patients convalescing from orthopædic conditions and fractures. In 1937, a great advance was made when a joint committee of the British Medical Association and the Trade Union Congress prepared a memorandum to the "Inter-Departmental Committee on the Rehabilitation of Persons Injured in Accidents".

With the advent of World War II, the necessity for organized medical rehabilitation became apparent. Shortages of manpower and the large numbers of service and civilian casualties contributed to the need. There was at this stage, therefore, considerable impetus, particularly in

the United Kingdom, to the development of medical rehabilitation services.

In January, 1943, the Tomlinson "Report of the Inter-departmental Committee on the Rehabilitation and Re-settlement of Disabled Persons", was read in the British House of Commons. This report made proposals for the introduction, as soon as possible after the war, of a scheme for rehabilitation and retraining for employment of disabled persons, such as those who had received fractures or were suffering from other physical disabilities —cardiac conditions, pulmonary tuberculosis, psychoses, neuroses, deafness, blindness and industrial diseases. The scheme included medical rehabilitation in hospital and at special centres, vocational guidance, vocational training at the Ministry of Labour retraining centres and resettlement in industry. The Ministries of Health, Pensions and Labour and National Services, and representatives of the Home Office, the Board of Education and the Treasury, worked together on this scheme.

This was a post-war scheme, which is now being put into operation in Great Britain; but in the meantime, medical rehabilitation was already being practised in the Army, the Air Force and the Emergency Medical Services. In addition, an accident service had been developed to rehabilitate miners injured in their employment at the coal face. The Midland Colliery Indemnity Association, formed by a group of associated companies, and representing the employment of over 100,000 men, was able by subsidies to ensure the development throughout the Midland areas of efficient fracture clinics. The association also provided for the establishment of a rehabilitation centre as part of this excellent service. This centre was organized to deal with 20% of injured miners who could not return directly to duty from hospital. It was established at Mansfield in Nottinghamshire, and Mr. A. E. Nicholl was appointed surgical supervisor. Since that time at least seven rehabilitation centres for miners have been established throughout the United Kingdom, all catering for the rehabilitation of men suffering from fractures and other physical injuries.

Early in 1940, Sir Reginald Watson-Jones was appointed civilian consultant in orthopædic surgery to the Royal Air Force. For ten years prior to the recent war he had striven to introduce properly organized rehabilitation centres for fracture patients, but without success. With the advent of war, and particularly during the "Battle of Britain" period, when casualties among aircrew personnel and skilled ground staff were high, some scheme to reduce disability periods and return valued personnel to effective duty as soon as possible was imperative. Watson-Jones, therefore, with the approval of the Director-General of Medical Services, Royal Air Force (Air Marshal Sir Harold Whittingham), introduced the first complete rehabilitation service of the war. Rehabilitation was developed in the Royal Air Force orthopædic centres and at five special rehabilitation centres. The Royal Air Force centres were so organized that all officers were treated in one centre, all aircrew non-commissioned officers in another, skilled ground staff personnel in a third and unskilled ground staff personnel in the other two. This arrangement was mainly one of convenience for easy control, and in effect showed good foresight, for it reduced administrative and disciplinary problems to a minimum.

During the war other experiments in rehabilitation were carried out. A. H. McIndoe, the New Zealand plastic surgeon, whose work at East Grinstead, Sussex, is famous not only to the medical profession, but also to hundreds of grateful airmen who have received treatment from him, developed a unique rehabilitation unit within the hospital. This unit actually contained a small aircraft production annexe, where patients could produce, under skilled supervision, aircraft precision instruments. The manual work they did aided considerably the restoration of function to their burnt and injured hands.

In Australia, the necessity of organization of physical rehabilitation services was not realized until later in the war—in fact, not until early in 1942, after the entry of Japan into the war. Again, the impetus was manpower shortages within the service due to illness or injury. Convalescent depots, since renamed medical rehabilitation units, were formed in each State. These units do not form part of a separate organized accident or surgical service, but are established for the purpose of effecting rapid return to duty of all patients admitted to Royal Australian Air Force hospitals with major surgical, orthopædic or neuropsychiatric disabilities. In principle they are similar to the rehabilitation centres in England, providing facilities for physiotherapy in all its forms, occupational therapy of every kind, physical training, recreational games, and education and resettlement facilities.

The Organization of Physical Rehabilitation in the Royal Air Force and the Royal Australian Air Force.

At the Hospital.

The application of physical rehabilitation in the Royal Air Force is confined almost entirely to the treatment of fracture and other orthopædic disabilities, and the value of correct supervision can be well demonstrated in these types of cases.

Every Royal Air Force orthopædic centre is under the control of an orthopædic surgeon of senior rank, and he has one or two surgeons to assist him. Medical orderlies are trained as rehabilitation orderlies, and it is their job to supervise the exercises of each patient. These orderlies, often jocularly called the "muscle mechanics", supervise the remedial exercises of each patient during the day to ensure that some exercise is done every hour. The orderlies have usually been chosen for their enthusiasm, their power of leadership, their ability to get the best out of all the patients they supervise. In addition they encourage occupational pursuits, organize light indoor games and generally promote a happy and cheerful atmosphere in the fracture wards.

At some Royal Air Force orthopædic hospitals physiotherapists are used for this supervision of functional activity. The same principle is in large part adopted in the orthopædic wards of the Royal Australian Air Force base hospitals. Here the physiotherapists are entirely in control of remedial exercises and other forms of physiotherapy. In the Royal Australian Air Force wards handcrafts and educational pursuits are encouraged to allay boredom and promote a cheerful frame of mind in all patients.

In the Royal Air Force orthopædic service not all patients go to the special rehabilitation centres. Those with minor injuries complete their treatment at the hospitals. Those with more serious injuries are transferred to the rehabilitation centres to complete their treatment as soon as further supervision in hospital is no longer necessary.

At Special Centres.

In the Royal Air Force orthopædic service, when further active hospital treatment is no longer necessary, certain patients are transferred to special rehabilitation centres. The more seriously injured are selected for transfer to these centres, because functional treatment cannot be completed satisfactorily in an orthopædic hospital. The centres provide freedom of space with gymnasia, playing fields, tennis and volley ball courts and swimming pools. The provision of these facilities enables exercise tolerance to be more accurately assessed, particularly as all activities are carried out under the supervision of medical officers. Here at these centres, away from the hospital atmosphere, the germ of chronic invalidism is more easily destroyed. These centres form an important part of the Royal Air Force orthopædic service, for the functional result of the surgeon's handiwork is assessed there. This cannot be done in hospital or in the out-patient section of the physiotherapy department of a hospital.

The staff at the Royal Air Force rehabilitation centres works as a team. Its teamwork is linked with the teamwork of the hospital staff by the regular visits of the consultant surgeons. These consultants are constantly visiting the orthopædic hospitals and rehabilitation centres, and they are able to maintain excellent unity of control.

One of the most interesting features to observe, and certainly one of the most pleasant to experience, is the excellent teamwork that exists from the consultants down to rehabilitation orderlies. This is entirely due to the enthusiasm of the man responsible for the scheme, Sir R. Watson-Jones. Every man or woman in the orthopædic service is made to feel, in some way or other, that he or she is contributing to the recovery and welfare of the patients. A word of praise here and encouragement there has undoubtedly welded the team together, and Watson-Jones never fails to praise a surgeon, physiotherapist or physical training instructor when praise is due.

The staff at the special centre is carefully chosen for it has "to inspire the patient with a spirit of enthusiasm". Treatment at the centre is supervised by a medical officer, and his team consists of physiotherapists, occupational therapists and physical training instructors or gymnasts. The medical officers are usually chosen for their knowledge of the principles of treatment in fracture and other orthopædic work. They must possess the right aptitude and personality and be sufficiently interested in the re-education aspect of orthopædic surgery.

The medical officer assesses each patient and "prescribes" a daily programme of activity and rest. He also supervises this activity to ensure that it is sufficiently specific and that it is given in correct doses. "Pep talks" to encourage progress must be given when necessary, and the medical officer not only "works in the gymnasium, but on the playing fields and in the swimming pool side by side with his patient".

The physiotherapists have to possess the diploma of the Chartered Society of Physiotherapists. Occupational therapists have to be graduates of a recognized school of occupational therapy. The physical training instructors are selected from suitable trainees of the initial physical and recreational training courses. A representative from one of the major rehabilitation centres lectures on physical rehabilitation to a group of trainees of the physical and recreational training course, and volunteers are called for this work at rehabilitation centres. These volunteers are sent to various centres where they are kept under observation by the commanding officer, and after a three months' trial period, if they are still interested and have been found suitable, they are given an advanced course in remedial exercise therapy, and are then posted to the staff of the centres. Before selection, these instructors must prove themselves to have a genuine sympathy for and understanding of the psychological reactions of disabled persons. The physical training instructors or gymnasts are invaluable in creating the final degree of physical fitness, teaching patients to run and jump *et cetera*. They work in the gymnasium with the physiotherapists and under the medical officer's direction.

The day is arranged for each patient to ensure that he has general exercise and specific exercise as well as rest. The specific exercise is given in the form of remedial exercise and in the form of remedial occupational therapy. General exercise includes various grades of physical training and games of all types, some chosen for their remedial value and others for purely recreational purposes.

In addition to daily supervision by medical officers, patients are reviewed weekly and their activity is allowed to progress. At the conclusion of this functional treatment, and when maximum recovery has been reached, patients are medically boarded for disposal within the service or discharged from the service, according to the final results. The aim of treatment from the time of injury is to return the patient to his former employment or to a new employment suited to his final physical capabilities. If a man must be discharged from the service, a social rehabilitation service exists to ensure his retraining or resettlement in industry. Special retraining centres organized by the Ministry of Labour and National Service are available for the retraining of ex-service personnel.

The results of this accident and rehabilitation service of the Royal Air Force are as follows. The total number of in-patients treated in Royal Air Force orthopædic centres from June, 1940, to March 31, 1943, was 21,187. The Royal Air Force orthopædic rehabilitation centres did not open until five months after the hospitals, and the total number of admissions to the four major rehabilitation centres from June, 1940, to March 31, 1943, was 8,204. The results obtained among the first 13,500 in-patients were analysed; 85% of aircrews resumed flying duties, 96% of ground staff returned to duty, and less than 5% of officers and airmen had been invalided. The first 405 aircrew members to be treated at one Royal Air Force rehabilitation centre were followed up after their discharge to units, and of these 405, 333 (82·2%) returned to flying duties and 72 (17·8%) were permanently grounded. The 333 returned to flying duties were allocated as follows: (*a*) number returned to full operational flying duties, 168; (*b*) number with full operational categories, with no physical or neuropsychiatric disability, who were flying non-operationally prior to resuming operational flying (operational training unit personnel, and those doing refresher courses *et cetera*), 109; (*c*) number who were engaged on flying duties, but whose existing category did not allow operational flying, 56; the 72 men with non-flying categories were made up as follows: (*a*) grounded, but retained in the service, 42; (*b*) discharged from the service or repatriated, 30.

Royal Australian Air Force Rehabilitation Units.

The medical rehabilitation units of the Royal Australian Air Force are in many respects similar to those of the Royal Air Force. There is one important distinction, however, and this is that those of the Royal Australian Air Force cater for all types of medical and surgical patients who are in need of supervision during the convalescent period generally. However, orthopædic patients predominate at the larger rehabilitation units.

The rehabilitation units vary in size according to the variation in size of the air force community and the air force hospitals for which they cater. The two largest units, located at Warburton, Victoria, and Jervis Bay, New South Wales, can each accommodate 250 patients. Those at Southport, Queensland, and Victor Harbour, South Australia, can accommodate 100 patients. At Yanchep, Western Australia, and Mount Spec, Townsville, there are two small units of 50 beds. There are also units in the Darwin area and in New Guinea, but these serve the needs of patients convalescing from illnesses or injuries which have not been considered sufficiently serious for the patient to require evacuation for treatment in a base area.

The larger medical rehabilitation units resemble in their organization those of the Royal Air Force. The commanding officers have, in most instances, been attached to Royal Air Force rehabilitation units and have introduced many features of these units into the organization of the Australian units. However, there are certain departments, such as occupational therapy, which have possibly been developed more thoroughly in the Royal Australian Air Force units—for example, various activities are available from light handcrafts through carpentry, sheet-metal work and wireless telegraphy to the hardest forms of animal husbandry. Number 1 Medical Rehabilitation Unit, at Warburton, Victoria, has developed a model farm, including dairy farming, pig raising and poultry farming.

Educational facilities are well developed in the Royal Australian Air Force units. The educational officer controls such activities as musical appreciation and supervision of special studies which many patients can pursue during their stay at the units. He also arranges debates, group discussions and film shows. In conjunction with the area vocational guidance officer, he arranges for vocational guidance tests for patients whose discharge from the service is imminent. All the information that this officer gleans from a patient is passed, together with a report from the medical officer in the form of a rehabilitation assessment, to the group rehabilitation officer for the purpose of facilitating re-employment after discharge.

The staff at the Royal Australian Air Force medical rehabilitation units is essentially the same as at Royal Air Force centres, and the principles of treatment are identical in most respects.

FORMS AND PRINCIPLES OF TREATMENT IN PHYSICAL REHABILITATION.

What is the chief effect of a serious and protracted illness or an accident on an average healthy patient? From the purely physical point of view, the patient who is confined to bed for a long period after a serious surgical operation or severe injury, experiences diminishing physical power. Muscles become weak and atrophied, joints become stiff, bones become decalcified and vasomotor tone diminishes. If any of these conditions are not counteracted, the disability becomes unnecessarily prolonged and in some cases permanent.

The psychological effect of illness is most important. It naturally varies with different types of patients; but fear of permanent disability and the necessity of having to readjust the manner of living or of having to be dependent on others is present in all cases. In addition to the purely surgical and medical procedures of treatment, there are important aspects of a patient's disability that require careful attention.

When a fracture has united and the plaster splint has been removed, a considerable amount of work remains to be done to achieve maximum functional recovery. This could be achieved in a hospital physiotherapy department, but it would necessitate the patient's remaining at hospital as an in-patient or out-patient for a protracted period. Moreover—and more important—the hospital cannot provide the facilities that are features of medical rehabilitation units. Greater interest and enthusiasm can be engendered and more rapid progress secured by the exercises of running, cycling and swimming, and, therefore, treatment is more advantageously completed at centres where there are playing fields, swimming pools, gymnasia and facilities for tennis, bowls, badminton and other games.

Importance of Environment.

A patient who has spent many weeks or months in hospital and who has been subjected to hospital routine tends to become "hospitalized", and a change of environment is most important to aid recovery. At the hospital, treatment has on the whole been "passive" in nature. The patient has had things done for him, and frequently tends to become lord of his own particular small world.

At the rehabilitation centre the passive "hospital atmosphere" is purposely removed—there is an atmosphere of activity, and the patient is reminded on all occasions that he must now work to get well. To impress on the patient this need for hard work is the first essential of treatment. The medical officer in charge of the rehabilitation team is responsible for guiding each patient's recovery. When he has made himself fully aware of the patient's disability, he arranges a routine plan of treatment to be carried out under his supervision by members of his team. To gain the patient's cooperation it is essential that the medical officer has his complete confidence, and he can secure this largely by explaining to him in as simple language as possible the nature of his disability, and how the programme of activity arranged for him has been specially planned to overcome this.

It is generally agreed that it is the patient's response that matters—"his response on the one hand to the pain and trouble occasioned him, and on the other, to the kindness and skill which are at his service". The personal interest of one individual in the person and progress of the patient means a great deal to him—the doctor's active interest in the patient's progress backed up by regular accurate measurements is essential, and the doctor should ensure that the prescribed programme of exercises and rest has been carried out. Undoubtedly the phase of treatment after removal of the plaster cast is the most difficult and trying for the average patient; this is the phase when all types of fears leading to any form of neurosis or conversion hysteria can occur, unless he is put in the right frame of mind at the outset of his functional treatment, and kept there by constant supervision and constant "pep talks". Perfect understanding between patient and doctor, and constant personal supervision of the patient by the surgeon or medical officer, are, perhaps, therefore, the most important necessities for successful rehabilitation.

Physical Methods Used.

Physiotherapy.

In physiotherapy the emphasis is on activity, and the treatment used is mainly active muscle reeducation. Very few forms of passive treatment are used, these being mainly radiant heat of many types, including infra-red irradiation, which is used as a prelude to exercise.

Faradism and galvanism are used only to assist muscle reeducation after nerve injury. Indications for short-wave therapy rarely arise. Massage is another form of physiotherapy which is rarely practised. It is occasionally used to dispel subperiosteal or intramuscular hæmatomata, or to assist reduction of gravitational œdema should this have been allowed to occur.

Passive movements are not allowed except in cases of muscle paresis, in which the affected joint is put through its full range of movement. Assisted and resisted active movements, however, are frequently used. Should passive movement be indicated when active movements have not been entirely successful in restoring full movement of a joint, then one good passive movement in the form of a manipulation under anæsthesia is performed by the surgeon in charge.

Most of the orthopædic patients exercise in a large remedial gymnasium, off which are small annexes for more individual supervision or for infra-red irradiation, short-wave therapy and galvanism or faradism. At one of the large units there is also a room off the gymnasium containing a large hydrotherapy bath, ten feet square, which is particularly useful for people with muscle paresis.

This layout of the physiotherapy department, consisting of a large central gymnasium with annexes for heat treatment, hydrotherapy and individual supervision of patients in the early and difficult stages, is ideal. The gymnasium is fitted out with every variety of apparatus that is of use in restoring function. This equipment includes wall bars, a set of stairs, an inclined walking ramp the grading of which can be altered, a large ship's wheel with an attachment to increase or diminish resistance, roman rings, sets of static bicycles, an adult version of an "infant walker", rowing machines, pulley and weight systems and a large wall mirror.

The staff at work in the physiotherapy department consists of two or three physiotherapists and two or three physical training instructors or gymnasts. This staff works together as a team under the guidance of a medical officer. The medical officer holds frequent discussions with the members of the staff to keep them fully aware of every aspect of the condition of the patients they are supervising.

All patients in the early stages have individual supervision by the physiotherapists. As they progress and are in need of less supervision, they are grouped for their exercises which are performed in the gymnasium. The gymnasts take over from the physiotherapists to complete the treatment, teaching and putting the patients through hard and vigorous exercises. The medical officer decides when patients should be advanced for he is in a better position to decide than the physiotherapist, particularly as he is more acquainted with the full medical history and is responsible for directing the patient's daily activity.

All patients spend from one and a half to two hours a day in two sessions in the physiotherapy department. They are so grouped to allow efficient handling by the staff. Certain patients, at the discretion of the physiotherapist, are recalled at other times of the day to receive special supervision, should this be considered necessary by the medical officer.

Remedial exercises have long been accepted as the basis of functional recovery in fractures and other disabilities

of the locomotor system. In the use of remedial exercises the following general principles are always kept in mind, not only when this form of therapy is being applied to fracture and other orthopædic patients, but also in its application to the treatment of all patients convalescing from severe debilitating diseases. Exercises must be: (i) specific as well as general; (ii) always administered in correct doses; (iii) rhythmic in regard to contraction and relaxation; (iv) progressive in range, power and time; (v) variable in form (medical gymnastics, occupational therapy and recreational therapy). These principles have been well described by Ernest Nicholl, surgical director to the accident service of the Mansfield General Hospital, and surgeon in charge of the Miners' Rehabilitation Centre, Berry Hill Hall, Nottinghamshire. The principles outlined by Nicholl are used in the Royal Air Force and Royal Australian Air Force rehabilitation centres.

Specific or focal exercises are used to develop muscles which have been wasted as a result of disuse. In a good many cases general exercise will assist to redevelop these muscles, but the results depend on the use of any general movement in which the affected muscle normally takes part. Focal exercises are of great importance in injuries of the locomotor system, because in these conditions one limb or joint only is affected whilst other limbs are normal. The quadriceps muscle affords an excellent example of the need for "focusing" exercises. Extension of the knee to within 15° of full extension is performed principally by the *vastus lateralis* and *vastus intermedius* portion of the knee extensor. *Vastus medialis* is responsible for the final 15° of full extension. This portion of the quadriceps muscle wastes very rapidly in any disability affecting the knee joint, because the knee is usually held in a flexed position for comfort and so the *vastus medialis* is never used. This muscle wastes rapidly when the lower limb is immobilized in a full-leg length plaster cast for a fracture of the shaft of the tibia. The knee is usually immobilized with 15° of flexion to prevent rotation of the tibial fragments. If attention is not given to the thorough redevelopment of the *vastus medialis*, an unstable knee results, which is always "giving way". General exercise will not cure this disability. The rest of the quadriceps muscle will take care of itself, but unless special attention is given to the *vastus medialis* portion of the muscle group, disability will persist.

There is no necessity to emphasize the importance of general exercise; the value of graduated general exercise in improving good neuromuscular coordination is evident, not only after disease or injury of the locomotor system, but after any debilitating disease of any system. It is important at all times, however, to ensure that exercise is given in correct doses. There has been a tendency in the past to give exercises in homœopathic doses, but over-doses of exercise can be harmful. "The weaker the muscle the less should be the demand made on it both in stress and time."

"All therapeutic exercises should be rhythmic, the contraction must be followed by relaxation, and the relaxation must be complete and long enough to allow normal circulatory conditions to be restored in the muscle before it begins its next contraction." Sustained contractions without sufficient relaxation are harmful.

Exercise should also be progressive. Muscles should be made to contract with gradually increasing stresses through increasing ranges of movement over increasing periods of time. "Progression must be in three dimensions—in range of movement, in power of movement, and in duration under stress. By far the greatest of these is power." A joint with good range of movement, but under weak muscle control, is far less efficient than a joint with limited movement, which nevertheless is under powerful muscle control—so progression in power is absolutely essential in exercise therapy.

To make exercise interesting and to prevent boredom and loss of interest, exercise must be varied in form. For this reason full use is made of occupational therapy and recreational therapy in the form of games.

Occupational Therapy.

Occupational therapy is a method of exercise therapy designed to restore power, movement and skill (or coordination) to a damaged limb by making use of the natural activity of purposeful work. It has also been described as "an objective type of treatment prescribed by the physician to hasten the patient's recovery from disease or injury or to contribute to his adjustment to hospitalisation".

At Royal Australian Air Force medical rehabilitation units, as will be indicated later, full use is made of this valuable form of therapy. It is generally divided into two main branches: (i) physical; (ii) psychological. Physical occupational therapy is practised in the rehabilitation of physical disabilities after trauma and disease, psychological occupational therapy in the treatment of mental disorders.

Physical occupational therapy is usually described as being remedial or diversionary, although in effect there is very little distinction between remedial and diversionary therapy. In general, if an occupation is devised by the therapist for the purpose of restoring function to a limb, the occupation can be regarded as specifically remedial. When an occupation is devised purely to keep a patient mentally occupied and happy while he is resting physically, it is regarded as diversionary, although strictly it is also remedial in effect because it still contributes to the patient's recovery.

Forms of occupational therapy vary in the Royal Air Force and Royal Australian Air Force rehabilitation services, although there are features in common. In the Royal Air Force the "arts and crafts" type of occupational therapy finds its great application in the hospital wards, where there are many idle hours to fill. Watson-Jones regards workshop activities, such as carpentry, fitting and turning, wireless telegraphy and the rest, as useful amenities to have at a rehabilitation centre when the weather prevents outdoor activity. "But", he says, "a remedial workshop is not a rehabilitation centre."

At the Royal Air Force rehabilitation centres, occupational therapy departments as we know them in Australia, have not been fully developed. Great use, however, has been made of remedial games of a graded nature, and patients have one or two hours per day at pleasant exhilarating outdoor activity. This is a recreational form of occupational therapy which will be mentioned later. For diversionary purposes the Royal Air Force has made available at aircrew rehabilitation centres, Link trainers and facilities for the study of navigation. At one aircrew centre they have assembled an old bomber on the grounds of the unit, in which the men in their leisure moments can climb around and try out for themselves their ability to reach and use the various controls. The value of making available such facilities lies mainly in their stimulating effect on certain aircrew personnel who have been away from flying duties for long periods.

At a maxillo-facial and plastic surgery unit at East Grinstead, Sussex, A. H. McIndoe has tried an interesting experiment in the use of occupational therapy. He has developed an industrial therapy department at his hospital. His maxillo-facial and plastic surgery unit comprises 90 beds, most of which are occupied by air force personnel who are mainly aircrew. Approximately 50% of the conditions treated are facial injuries, burns, fractures and soft-tissue defects; 50% are injuries to the rest of the body—skin losses from trauma or other tissue contractures causing deformity of orthopædic significance. The problem in the former group is mainly psychological, and in the latter group functional restoration is paramount.

To provide occupations to satisfy the need of these two groups, his occupational therapy department was turned into an industrial therapy department. Lathes were set up and most modern equipment was installed for the assembling of aircrew precision instruments. Constant supplies of parts arrive weekly from the factory near by, and are assembled by the working patients under the direction of a skilled technician supplied by the factory, and four girl workers, one of whom instructs at each

bench. McIndoe states that the work is clean, interesting and of great remedial value, particularly for burnt and crippled hands. The patient feels that it is of national importance. To avoid monotony patients change to benches where different work is being done.

In the Royal Australian Air Force medical services, occupational therapy has been developed along the orthodox lines. At the hospitals light crafts have been extensively introduced to allay boredom consequent to confinement to bed over long periods. Generally the work at hospitals is carried out under the supervision of a Red Cross craftworker, and takes the form of diversionary craftwork. At some of the larger Royal Australian Air Force hospitals, which are part of a combined service hospital, full use is made of the army occupational therapy department, which is under the command of a fully trained army occupational therapist and her staff. At the rehabilitation units workshops have been established for such occupations as carpentry, fitting and turning, wireless telegraphy, pottery and several of the light crafts including leather-work, weaving, basket-making, netting *et cetera*.

The rehabilitation units have on establishment a fully qualified occupational therapist, and she has as her assistant an officer in charge of the diversionary crafts, a carpentry instructor, and instructors for wireless telegraphy, sheet-metal work, and fitting and turning. The workshop provides interesting diversions for patients suffering from neuroses, and for those recovering from severe medical diseases, such as acute rheumatic fever, nephritis, diarrhœal diseases *et cetera*, in which rest and relaxation are as important as graded exercise.

Orthopædic patients, particularly those with upper limb injuries, gain considerable functional activity from supervised occupations in the workshops. Those with hand injuries in particular benefit from light crafts such as netting, weaving, basket-making *et cetera*. It is most difficult to devise exercises for fingers and wrists, and it is tedious exercising joints of the hand. In doing craftwork the patient is unconsciously exercising these joints and improving neuro-muscular coordination.

In addition to the workshop activity, hard "man-size" occupations, all of which can be used to complete restoration of power and mobility to limbs and joints, are available at centres in the form of animal husbandry, vegetable gardening, flower gardening, wood chopping and unit maintenance. All of these various activities must be well supervised if the desired result is to be achieved. It is impossible for the occupational therapist to keep an eye on all the patients, and it has evolved that she devotes most of her time to patients in the early stages employed on the light crafts. Her staff, as has previously been mentioned, assists her in the workshop in keeping control and in instructing the men in their crafts.

Outside activities on the farm and in the gardens are generally supervised by the barrack's officer and his staff, to whom patients are attached for "duty".

Recreational Therapy.

Games, which are widely used in physical rehabilitation at Royal Air Force and Royal Australian Air Force centres, are usually regarded as a form of recreational therapy. In addition to their recreational value, they have a definite remedial value. For purposes of supervision they are controlled by the physical and recreational training staff, under the command of the physical and recreational training officer. The games are chosen for their remedial value in promoting recovery by "impulsive movements". They are carefully supervised by medical officers to ensure that full remedial value is obtained. The medical officer is able by this supervision to assess fairly accurately the degree of the patient's physical activity.

These games are wide in their variety, and a unit which has facilities for their full employment is fortunate indeed. The variety ranges from bowls, quoits and skittles, to archery, tenniquoits, badminton and volley ball, basket ball, tennis, softball, golf, cricket and football. Most of the units have swimming facilities, and this sport is the activity *par excellence* for all disabilities. The sports, like all other forms of occupational therapy, are "prescribed" by the medical officer, and it is the duty of the physical and recreational training staff to see that the patients use their injured parts fully. The games are supervised by the medical officer, to ensure that the instructors are fully aware of this necessity and that it is properly observed. The physical and mental enjoyment derived from games and the competitive spirit that can be engendered in them make them invaluable for restoring function when properly supervised.

Apart from its value in aiding functional recovery, occupational therapy in its many guises enables the surgeon in charge, from his observation of the patient, to arrive at a correct assessment of the patient's capacity for work or play. In this regard, occupational therapy as employed at a rehabilitation unit is most valuable, for at these units the scope for its employment is more vast than at a hospital. The patient, too, is less confined, and his reactions can be more fully observed by medical officers whose job it is, in conjunction with the occupational therapist, to control and supervise this activity. The knowledge gained from observation of the disabled man's reactions to work and play is a great help in arranging prevocational training for future employment.

Resettlement.

"A disabled man, despite his disability, should be an asset and not a burden." Every disabled man can be retrained for some employment, and his handicap can be minimized. In former years resettlement of the disabled in employment was approached compassionately, and there is still a tendency to do this. Retraining and employment of all disabled persons should be approached realistically.

It is degrading to employ a man on duty which he knows to be unimportant and unnecessary and specially provided as a concession—for example, the employment of unwanted commissionaires and lift attendants. However, all the good work of the surgeon and his team can be ruined by the returning of disabled men to employment which, although useful, is beyond their physical capabilities. The mental effect on the man who realizes that he is physically incapable of doing the job satisfactorily is as adverse as the mental effect on the man who knows his job is superfluous. The question of resettlement in useful employment is important—it is equally important, in fact, as all the other and earlier phases of the man's rehabilitation.

In the air forces of Great Britain and Australia the aim of the service doctors and their teams of helpers has been to restore all injured and ill servicemen to their former service duties as soon as possible and in the best possible state of health. In the majority of cases this has been achieved; but for the small percentage who have been permanently disabled, resettlement in more suitable employment within the service has been possible.

Facilities exist within the Royal Australian Air Force administration for the rapid remuster of servicemen rendered permanently medically unfit, for their former service employment, provided they are physically capable of work in another mustering. These men can be retrained and resettled in their new job. Certain of these men may be on reduced medical categories, so rendered fit for limited duties either temporarily or permanently. Arrangements can be made for their periodic medical review and if necessary for further treatment. This, then, can be regarded as complete and perfect rehabilitation.

What is done, however, for the man who has been found permanently unfit for service duties and who must be discharged? His resettlement is a major problem. Every consideration is given to the resettlement into civilian employment of such permanently disabled airmen. In the Royal Australian Air Force this is arranged by close cooperation of the medical officers with social rehabilitation officers. At the final invalid medical board prior to the discharge of the serviceman, all information to assist the rehabilitation officer in finding him suitable employment is supplied. In addition, these disabled men are vocationally guided to determine in what direction their aptitude lies.

This information, together with that given by the medical officers, is of considerable help to the rehabilitation officer in finding suitable and useful employment. When employment is found, the rehabilitation officer maintains frequent contact to check the progress made in the new work. This contact is maintained until the servicemen are well and happily established in their new employment.

In the Royal Air Force service the rehabilitation officer usually accompanies the consultant surgeon to the rehabilitation centre, and is able on the spot to confer with the disabled serviceman whose discharge from the service has been recommended by the consultant. He is able to obtain at first hand the consultant's opinion as to the man's fitness for the civilian employment of his choice. This rehabilitation officer, as in the Royal Australian Air Force, keeps in close contact with the disharged disabled man and maintains close supervision of his progress. A facility existing in the Royal Air Force service allows the permanently disabled serviceman a trial at a civilian employment. At the completion of this trial he is reviewed by the consultant surgeon, who is supplied with a report from the rehabilitation officer, which details the airman's physical and mental aptitude for his work.

In England today, apart from what has been done in the Royal Air Force, there is a growing appreciation by the government of the necessity to create the opportunity for employment of the disabled. During the war, exigencies of that period made it necessary to enlist the full manpower of the nation, but in peace time this opportunity for employment has been given because it is realized that the disabled are capable and worthy of employment. The British Council of Rehabilitation was recently formed in England to assist and advise the government on the whole problem of resettlement and reemployment of the disabled. This council is also coordinating the work of the surgeons with the physiotherapists, occupational therapists, gymnasts and social workers. It is also arranging training facilities for the staff which is required to carry out this vast programme.

Let me conclude with some words of Watson-Jones:

> In relieving the handicap of the disabled person our task is to complete his treatment, explain his problems, anticipate his fears and reassure his mind, to offer hope and give confidence—confidence in the future. We must re-establish for him normal family life, normal employment and normal recreation, and re-instate him in the privileges and duties of citizenship.

SUMMARY.

1. Medical rehabilitation is defined as the restoration to the privileges of health.

2. The development of medical rehabilitation in Great Britain since the war of 1914 to 1918 is described, and special reference is made to the organization of a medical rehabilitation service within the Royal Air Force orthopædic service and the Royal Australian Air Force medical service.

3. The present organization of physical rehabilitation in the Royal Air Force and Royal Australian Air Force is outlined in detail, and the importance of maintaining good teamwork of staff both at the hospitals and at special centres is emphasized.

4. The results of the organization in the Royal Air Force are given.

5. Forms and principles of treatment used in physical rehabilitation, which include physical therapy, occupational therapy and recreational therapy are described.

6. Resettlement of the disabled and the system used within the Royal Air Force and Royal Australian Air Force are outlined.

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THE RESISTANCE OF HÆMOPHILUS INFLUENZÆ TO THE ACTION OF PENICILLIN, WITH SPECIAL REFERENCE TO TYPE B STRAINS.

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IN an article by North, Wilson and Anderson, which appeared in this journal on February 16, 1946, on the treatment of *Hæmophilus influenzæ* meningitis by sulphonamides in conjunction with *Hæmophilus influenzæ*, type *b*, rabbit antiserum, it was stated that penicillin was not efficacious in *Hæmophilus influenzæ* infections. In view of recent references to the action of penicillin on *Hæmophilus influenzæ*, we are submitting the following short report of our own experience as an addendum to the original article.

Since Fleming's (1929) original paper on the antibacterial action of cultures of a penicillium, *Hæmophilus influenzæ* has been generally regarded as a classical example of a penicillin-fast organism.

Keefer *et alii* (1945), in what may be looked on as an official pronouncement, place *Hæmophilus influenzæ* infections amongst those conditions in which penicillin is ineffective. Martara *et alii* (1944) confirm earlier reports of the non-susceptibility of *Hæmophilus influenzæ* to penicillin.

Bloomfield, Armstrong and Kirby (1945), reporting on a series of patients suffering from bacterial endocarditis treated with penicillin, record one with "influenza bacilli", the course of whose illness was entirely unaffected by penicillin.

Among the case histories comprised in the report of North, Wilson and Anderson (1946) on the use of sulphonamides together with specific rabbit antiserum in the treatment of influenzal meningitis, were a few which

showed that penicillin had been unsuccessfully tried before serum therapy was commenced. In addition, Dr. Elizabeth K. Turner, medical superintendent of the Children's Hospital, Melbourne, whose clinical experience with influenzal meningitis is probably unrivalled in Australia (Turner, 1945), has since then expressed the opinion to one of us (E.A.N.) that penicillin is not a satisfactory substitute for specific serum against the infection.

Recently, however, reports have appeared in the English literature suggesting that some strains of *Hæmophilus influenzæ*, type *b* (the type associated with influenzal meningitis), are sensitive to penicillin, and that some patients with influenzal meningitis respond favourably to penicillin in conjunction with sulphonamides.

Forgacs, Hutchinson and Rewell (1945) have recorded two strains of *Hæmophilus influenzæ*, type *b*, moderately sensitive to penicillin—a report confirmed by Straker (1945).

Since the work here reported was done, McIntosh and Drysdale (1945) have recorded the recovery of a child, aged two and a half years, after treatment with penicillin and sulphamezathine, whilst Gordon and Zinnemann (1945) have reported on the in-vitro sensitivity of 61 strains of *Hæmophilus influenzæ*, 16 of which belonged to type *b* and were isolated from cerebro-spinal fluid. In all of the last-mentioned instances, growth was completely inhibited by five units of penicillin per millilitre; only two were resistant to two and a half units per millilitre.

Materials and Methods.

Fifty-five strains of *Hæmophilus influenzæ* were tested; 51 were of type *b*. Of these, 44 were isolated from the cerebro-spinal fluid of patients suffering from influenzal meningitis and forwarded to these laboratories for typing over the past two years. (During this period 86 type *b* strains have been received, but 42 have been discarded.) Six strains (the oldest having been maintained in the laboratory for eleven years) were selected at random from the stock collection in the vaccine department, whilst the remaining strain in the series was obtained late in 1943 by Major P. L. Bazeley, O.B.E., from Dr. Hattie Alexander, of the Presbyterian Hospital, New York. All our own strains isolated from cerebro-spinal fluid proved to be morphologically, culturally and serologically (agglutination and precipitation) indistinguishable from Dr. Alexander's.

Of four strains of *Hæmophilus influenzæ* not type b, three came from the vaccine department and one was isolated from a throat culture by us a few weeks before being tested.

All *Hæmophilus influenzæ* cultures have been maintained here on chocolate agar.

In-Vitro Penicillin Sensitivity Tests.

In-vitro penicillin sensitivity tests were carried out (*a*) in Levinthal broth, (*b*) on Levinthal agar.

(*a*) Penicillin was added to Levinthal (1918) broth, which was then dispensed in quantities of two millilitres into small test tubes. The penicillin broth was inoculated with a fine platinum loop from overnight chocolate agar cultures of *Hæmophilus influenzæ*. The results were read after twenty-four hours' incubation at 37° C. Any cloudiness or turbidity was taken to indicate growth. The standard penicillin-sensitive strain of staphylococcus, "F.D.A. 209", and a typical penicillin-resistant strain, "Crotty", served as controls.

(*b*) Penicillin was added to Levinthal agar (two parts nutrient agar and one part Levinthal broth) just before the plates were poured at 45° C. The plates were then "spot" inoculated, several strains being tested on each plate, and examined after twenty-four hours' incubation at 37° C.

In-Vivo Sensitivity Test in Mice.

Mice weighing 18 to 22 grammes were injected intraperitoneally with a six-hour Levinthal broth culture of *Hæmophilus influenzæ* suspended in mucin. The mucin was prepared according to the direction of Alexander and Leidy (1943), Wilson's Laboratories Granular Mucin, type 1701W being used. The penicillin was injected subcutaneously.

"Penicillinase" Production. — The production of a penicillin-destroying agent by *Hæmophilus influenzæ*, type *b*, was tested for by a method devised by one of us (Anderson, 1946). This consists essentially of the incorporation of 0·25 unit of penicillin per millilitre in an agar medium together with 2% by volume of an eighteen hours broth culture of a standard penicillin-sensitive strain of staphylococcus. After the plate has been poured and dried, it is inoculated with the test organisms in such a way that the inoculated surface forms the sides of a hollow square one centimetre wide. If penicillinase is produced, numerous colonies of the staphylococcus appear in and around the hollow square formed by the growth of the penicillin-fast organism.

Results.

The results of the penicillin sensitivity tests in Levinthal broth are shown in Table I. The time since the strains tested had been isolated ranged from two days to sixteen years (one of the strains not of type *b*), but no correlation between sensitivity to penicillin and the age of the strain was found. Further, no difference was noted in the effect of penicillin on type *b* strains as compared with those not of type *b*. Sub-cultures were made at random from some tubes containing the lowest concentration of penicillin in which no growth was apparent, and no growth took place; this indicated that the action of the penicillin was not only bacteriostatic but bactericidal.

Table I also shows that under the conditions of this test *Hæmophilus influenzæ* was only slightly less resistant to

TABLE I.
Inhibition of Growth of Hæmophilus Influenzæ by Penicillin in Levinthal Broth.[1]

Type of Organism.	Number of Strains.	Units of Penicillin per Millilitre of Broth.									
		0·06	0·13	0·25	0·5	1·0	2·0	4·0	8·0	16·0	Nil. (Control.)
Hæmophilus influenzæ, type *b*.	5	/	/	/	+	+	−	−	−	−	++
	29	/	/	/	++	+	+	−	−	−	++
	17	/	/	/	++	++	+	+	−	−	++
Total	51										
Hæmophilus influenzæ, not type *b*.	1	/	/	/	+	+	−	−	−	−	++
	2	/	/	/	++	+	+	−	−	−	++
	1	/	/	/	++	++	+	+	−	−	++
Total	4										
Staphylococcal controls: Standard sensitive "F.D.A. 209" ..	—	+++	−	−	−	−	−	−	−	−	+++
Penicillin-fast "Crotty"	—	/	/	/	+++	+++	+++	+++	+++	−	+++

[1] The results were recorded after twenty-four hours' incubation at 37° C.; "+++" = heavy growth, "++" = moderate growth, "+" = slight growth, "−" = no growth, "/" = not tested.

the action of penicillin than the typical penicillin-resistant staphylococcus "Crotty".

When tested on Levinthal agar, all the strains, type *b* and those not of type *b*, behaved identically, growing in the presence of twenty units of penicillin per millilitre of medium. The standard sensitive strain of staphylococcus, "F.D.A. 209", grew only in medium containing 0·1 unit per millilitre or less, and growth of the penicillin-resistant strain, "Crotty" was almost entirely inhibited by twenty units per millilitre.

Table II gives the protocol of an experiment on mice infected intraperitoneally with *Hæmophilus influenzæ* suspended in mucin. The mice treated with penicillin received 1,000 units of the calcium salt one hour before infection and a further 1,000 units fifteen minutes after infection. Both doses of penicillin were administered subcutaneously. The results are statistically highly significant and compare favourably with the results obtained by us with specific rabbit serum. The mucin technique of injecting mice with *Hæmophilus influenzæ*, however, has not proved altogether satisfactory in our hands. We have found considerable irregularity in the killing dose in the one experiment so frequently that we consider the method unsuitable as a means of assay for any therapeutic substance against this organism. Nevertheless, we do consider that it affords some indication of therapeutic adequacy or otherwise of such a substance.

Two of our most recently isolated strains of *Hæmophilus influenzæ*, type *b*, have been tested by the plate method described above for evidence of the production of a penicillinase. The result—no growth of colonies of staphylococcus within the hollow square—indicated that no penicillinase was produced.

Discussion.

The results of the in-vitro sensitivity tests recorded in this paper are in substantial agreement with those of Gordon and Zinnemann (1945), although the sensitivity of their strains appears to vary somewhat more. We have noticed that slight differences in technique make a considerable difference in the apparent resistance of a strain. For example, if the inoculation on the penicillin medium is made from a culture grown for more than one day, the resistance to penicillin appears to lessen. Gordon and Zinnemann are cautious in expressing an opinion on the probable value of penicillin in influenzal meningitis, but consider that it is worthy of a trial in Great Britain, where specific rabbit antiserum is not available.

The failure of *Hæmophilus influenzæ* to show evidence of penicillinase production is of interest. Penicillinase production is a feature of in-vivo penicillin-resistant staphylococci (North and Christie, 1946). If they are present in only comparatively small numbers, penicillin may be efficacious, as they produce a comparatively weak penicillinase. This is borne out by the results of an investigation (not yet published) carried out by one of us (E.A.N.) in association with other workers, which suggest that the presence of some at least of these penicillinase-producing staphylococci does not necessarily delay the healing of infected wounds.

Hæmophilus influenzæ, on the other hand, resists the action of penicillin without destroying it; our experience would suggest that penicillin can be effective only if maintained in a high concentration in close contact with the infecting organisms.

Whilst the experiment on mice infected with *Hæmophilus influenzæ* and treated with penicillin is suggestive, we do not consider that it should be regarded as proof that penicillin would necessarily be effective in the treatment of influenzal meningitis.

The results recorded by Forgacs *et alii* and by McIntosh and Drysdale are encouraging but not conclusive. Both patients who recovered were over two years of age and were treated with sulphonamides as well as penicillin. The prognosis is comparatively good for children in this age group when treated with sulphonamides alone; in the series collected by North, Wilson and Anderson there were 20 recoveries out of 53 cases.

The position at present is somewhat as follows. A highly significant reduction in the death rate from influenzal meningitis has followed the introduction of sulphonamides and specific rabbit antiserum. Some individual records of success with penicillin in conjunction with sulphonamides have been published, but so far no statistically adequate series of patients so treated have been reported. In-vitro penicillin-resistance tests do not encourage the view that penicillin may be a satisfactory substitute for specific antiserum.

Conclusions.

1. Reports of cases of influenzal meningitis treated with penicillin are briefly reviewed.
2. Laboratory tests on 55 strains of *Hæmophilus influenzæ* (51 from the cerebro-spinal fluid of patients with influenzal meningitis) show that all are highly resistant compared with a standard penicillin-sensitive staphylococcus.
3. *Hæmophilus influenzæ* does not produce a penicillinase.
4. Clinical and laboratory evidence does not suggest that penicillin is a satisfactory substitute for specific rabbit antiserum in the treatment of influenzal meningitis.

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Table II.

The Effect of Penicillin Treatment on Mice Infected Intraperitoneally by Hæmophilus Influenzæ Suspended in Mucin.[1]

Infecting Dose of *Hæmophilus Influenzæ*. (Approximate Number of Organisms.)	Penicillin in Units per Mouse.	Number of Mice.	Fate of Mice.[2]	Comments.
50,000	Nil.	6	+1 +2 S S S S	
500,000	Nil.	6	+3 S S S S S	Total deaths, 11 out of 24.
5,000,000	Nil.	6	+2 +2 +2 +3 S S	
50,000,000	Nil.	6	+2 +2 +2 +2 S S	
50,000	2,000	6	S S S S S S	
500,000	2,000	6	S S S S S S	No death in 24 test animals.
5,000,000	2,000	6	S S S S S S	
50,000,000	2,000	6	S S S S S S	

[1] Experiment terminated after seven days.
[2] Symbol "+" with the numeral indicates death and the day it occurred; "S" indicates survival.

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F. Martara, R. R. Feiner and E. Levenkrow: "Activity of Penicillin against H. Ducreyi in Vitro", *Proceedings of the Society for Experimental Biology and Medicine*, Volume LVI, 1944, page 163.
E. A. North and R. Christie: "Acquired Resistance of Staphylococci to the Action of Penicillin", THE MEDICAL JOURNAL OF AUSTRALIA, Volume I, February 9, 1946, page 176.
E. A. North, H. Wilson and G. Anderson: "The Treatment of Hæmophilus Influenzæ Meningitis with Sulphonamides in Conjunction with Hæmophilus Influenzæ, Type B, Rabbit Antiserum", THE MEDICAL JOURNAL OF AUSTRALIA, Volume I, February 16, 1946, page 215.
E. A. Straker: "Serological Typing of Meningeal Strains of H. Influenzæ", *The Lancet*, Volume I, June 30, 1945, page 817.
E. K. Turner: "A Further Report on the Treatment at the Children's Hospital, Melbourne, of Influenzal Meningitis with Sulphonamides and Type-Specific Serum", THE MEDICAL JOURNAL OF AUSTRALIA, Volume I, March 3, 1945, page 219.

A TROCAR AND CANNULA FOR THE INTRAVENOUS ADMINISTRATION OF FLUIDS.

By RONALD V. PRATT,
Balranald, New South Wales.

DESPITE an impressive array of needles and cannulæ of various patterns which are catalogued today for use in the intravenous administration of fluid, I venture to submit the following notes on a rather delicately made trocar and cannula. I venture to do so because I have found that in practice this instrument possesses certain material advantages, uncombined (so far as I know) in other types of needle available in this particular field.

The instrument, which is constructed of stainless steel, consists essentially of a finely made and well fitting trocar within a cannula whose internal diameter is 17 British Whitworth gauge. There is also a rubber tubing adapter with a simple locking device for attachment to the usual saline or other reservoir. The cannula has an effective length of 1·5 inches. Its distal end has been made practically flush with the point of the trocar, in order to minimize any resistance to tissues penetrated. The trocar, though fitting snugly, is nevertheless easily and smoothly withdrawn from its bed. Its point is similar to that of a

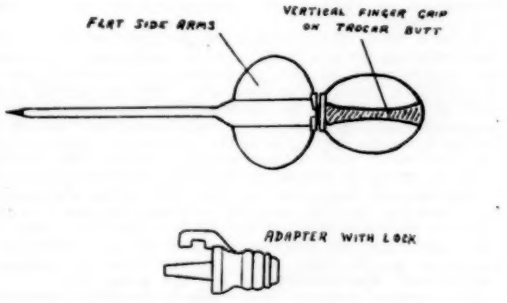

FIGURE I.

triangular cutting-edged needle with a long bevel, and it is delightfully sharp. It is provided with a substantial finger-grip above the butt-plate, and this is all that needs to be held during the piercing of a vein.

It has always appeared to me that the blunt cannula, in one form or another, is the ideal instrument through which to run fluids continuously into the venous circulation. It may be left safely *in situ* in the vein without fear of its being too easily dislodged, or of its accidentally piercing the vein wall as a result of restless movements of the patient or other untoward disturbances. As employed at present, however, it suffers from the undoubted disadvantage that one has to cut down on a vein, dissect it out, tie the cannula in place, and frequently spoil that particular vein for future use. Furthermore, provision is not usually made for clearing the cannula speedily should clotting occur—a not infrequent occurrence.

On the other hand, the use of a sharp-pointed hollow needle, while rendering cutting down on the vein unnecessary in most cases, has even greater disadvantages. It is not always possible to thrust a needle, connected directly to a reservoir of fluid under pressure, into a vein and be sure that it is properly within the lumen of the vessel; only too often will a tell-tale swelling appear in the surrounding tissues and another attempt be necessary. Special vein-seeking methods to overcome this difficulty are, I think, over-elaborate and unnecessary. And then, when the needle is finally inserted, it is rarely possible to push it far up the lumen of the vein without piercing the wall and producing a most unwelcome hæmatoma and impaired flow. Thus one must leave the needle point precariously within its place of entry, and consider oneself fortunate if dislodgement or blockage of the needle or transfixion of the vein wall does not sooner or later occur through some unavoidable circumstance.

Using the trocar and cannula described, I have found it as easy to enter a vein as with a syringe and needle, and without any need for cutting down. Removal of the trocar enables one to determine quickly whether the cannula is within the vein by the appearance or otherwise of blood. The adapter, to which is already attached rubber tubing from the infusion apparatus, is then instantly locked in place, and the infusion is under way. The cannula can usually be safely pushed along the lumen of the vein up to its full length of one and a half inches, and one thin strip of adhesive plaster over the side arms will hold it in place without further fear of dislodgement or transfixion. If the flow stops at any time, it takes only a moment to slip off the adapter and clear the cannula with one motion of the trocar.

I have employed this little device in the continuous administration of "Pentothal" and in the giving of various types of "Soluvac" fluids by drip infusion. The manner in which it has facilitated the institution and maintenance of these procedures has been most gratifying.

Acknowledgements.

I should like to acknowledge the generosity of Dr. J. H. Lindell, medical superintendent of the Royal Melbourne Hospital, and Dr. G. M. Bedbrook, surgical registrar of the Royal Melbourne Hospital, in using this device in a larger number of intravenous administrations of saline solution and of serum and blood transfusions than it was possible for me to obtain here. Their favourable report on its advantages has encouraged me to feel that it may serve a useful purpose in facilitating the practice of intravenous methods. The trocar and cannula with adapter were made for me by Messrs. Felton, Grimwade and Duerdins, of 21, Alfred Place, Melbourne, from whom the instruments may be obtained.

Reviews.

ATOMIC ENERGY.

SINCE August 6, 1945, when the news of the use of atomic energy on Hiroshima was released, all thoughtful people have become acutely aware of the progress of science and as equally interested in the future possibilities. The official report made by the United States Government on developments leading up to the atomic bomb states that scientists have a responsibility to explain to their fellow citizens the potentialities of the new source of power. In his "Atomic Energy in the Coming Era", David Dietz[1] has given an account which is intended to discharge that responsibility.

[1] "Atomic Energy in the Coming Era", by David Dietz; 1945. Sydney: Angus and Robertson Limited; New York: Dodd, Mead and Company. 7½" × 5", pp. 186, with illustrations. Price: 12s. 6d.

The author, a university lecturer in general science, the science editor of the Scripps-Howard chain of newspapers, and a winner of the Pulitzer Prize in Journalism, combines in an attractive manner an excellent descriptive power with detailed scientific accuracy. As a result, the book is readily understandable by those with no claims to a scientific education, and yet contains none of the inaccuracies so often met with in popular scientific journalism.

The author throughout stresses the fact that scientific discoveries are not so much the result of single-handed effort as the natural progress of painstaking investigation when one worker builds on the knowledge of another. He traces first the growth of the atomic theory from hypotheses of the Greek philosophers through the laws formulated by the early chemists to the physical discoveries, at the end of the last century, of X rays, radio-activity and the electron. Subsequent developments of theories of atomic and nuclear structure are traced with particular reference to the experimental evidence on which each successive step was based.

With this background, the ordinary reader will have no difficulty in understanding the process of nuclear fission and in following the investigations in different countries during the war years until finally the atomic bomb was realized, was tested in New Mexico and three weeks later was used in Japan. The interest is well maintained with explanatory diagrams, photographs, quotations from official documents, and brief personal notes on the more prominent workers.

Finally, the author predicts some of the possible peacetime uses of atomic energy and emphasizes that the arrival of the atomic era will depend upon the manner in which scientific research (not only in the atomic, but in every scientific field) is directed and fostered.

All who wish to understand something of the modern story of physical science should read this book.

A MANUAL OF TUBERCULOSIS.

THE sea of tuberculosis is very wide, the voyager will meet with many conflicting currents, and there are many unplumbed depths. Dr. Ashworth Underwood has launched his "Manual of Tuberculosis, Clinical and Administrative", across this sea, and indeed his ship is well found, although somewhat small in size for the cargo carried.[1] What we mean is that too much seems to have been packed into this manual in its third edition, and there is a tendency, perhaps, to over-simplification. Still, as the author points out in his preface to this third edition, it is very difficult to find amongst existing textbooks one that gives a fully comprehensive account of the varied aspects of tuberculosis and their interdependence on each other. The adequate treatment and control of this disease demand close cooperation between a wide variety of workers, from the worker in preventive medicine and from the clinical side (including physician, surgeon and pathologist), to workers in other fields such as radiology, physical therapy and sociology. Dr. Underwood has not neglected the importance of the psychological problem in dealing with the tuberculosis sufferer.

The printing is clear, illustrations are numerous and good, and X-ray pictures are reproduced as easily read negatives and not as blurred positives which are too frequently seen. This book should prove of great use to students, practitioners, and, because of its simplicity of presentation of facts, to the layman concerned with tuberculosis administration. One might add that even the thoracic surgeon might find it a helpful introduction to the wider aspects of the tuberculosis problem, enabling him to glimpse himself in true perspective in antituberculosis schemes.

PRACTICAL NURSING.

IT is two years since the first edition of "Modern Practical Nursing Procedures", by M. K. Doherty, M. B. Sirl and O. I. Ring, was published, and the fact that a reprint and a second edition have appeared in that short space of time indicates the worth and usefulness of the book.[2] The authors are to be congratulated on the excellence of their collective efforts. As Australians we lean largely on overseas textbooks, and it is pleasant to see that gradually more and more such books are being published in this country. This book is of great value to all nurses, and the practical teaching experience gained by the authors as tutor sisters at three of Sydney's largest hospitals is ably reflected in their writings. Besides nurses, doctors who lecture to nurses will obtain help from the book. Chapters on certain subjects have been written by medical men, each of whom is a specialist on the subject with which he deals.

All phases of nursing are dealt with, from methods of ward routine to the nursing of patients for individual illnesses. The nursing of infectious diseases is fully described, and it is also good to see such a full account of instructions about hypodermic injections, especially those of insulin, for the administration of these is a duty almost entirely left to nurses. Preparation of a room in a private home for use as an operating theatre, and the management of obstetric cases in the home are other aspects of nursing fully accounted. Last but not least is a chapter on advice on methods of study, a subject of great importance, for no student nurse has much time for study, and such time as she has cannot be wasted on blind alleys. There are some few omissions in the lists of instruments needed for set operations, and also little is mentioned about the nurses' part in the operating team. Every nurse or sister is an integral part of the team while she is in the operating theatre, and it is therefore surprising to see this aspect neglected. Neither general operative nor the specialized "no-touch" techniques are mentioned, and the modern theatre staff has to do far more than prepare the patient for operation, apply the dressings at the operation's conclusion, and handle bowls and check sponges.

Altogether this is an excellent book and should be on every nurse's shelf both in her student days and afterwards. It will be of great help to a private nurse who often needs some advice and yet who may not have anyone whom she can ask. She can confidently call on this book for aid.

WAR NEUROSIS.

GRINKER AND SPIEGEL'S "War Neuroses" is familiar to army medical officers who read it in 1944 as a "restricted" publication.[1] It contains an account of the authors' experience of front-line psychiatry in United States Army and Air Corps personnel during the Tunisian campaign.

The book is best read for its entertaining viewpoints based on thorough observation rather than as a cold text in psychiatry; no attempt is made to quote statistics and the extent of the material examined is not clearly defined. The case descriptions are graphic, and discussions of psychogenetic factors together with an appreciation of the scope of forward treatment are lively and stimulating. The clinical description of the soldier disorganized by fear is realistic and complete.

A good deal of attention is devoted to the results of "Pentothal-narco-synthesis" and a good case is argued for the employment of this technique in diagnosis and as a constructive therapeutic measure. Not all would find this method of treatment as successful in reconstruction of the personality as did the authors. Although their description of the mechanisms operating in the process of "narco-synthesis" contains much that is interesting, much of the related discussions of psychopathology may be regarded as speculative.

Grinker and Spiegel invest the "ego" with characters and functions not usually assigned to it, and somewhat colourful liberties are taken in describing, for instance, "ego span", "ego pain" and the suspiciousness of the ego. Perhaps such passages would read more convincingly if "patient" or "individual" was substituted for the term ego.

The section dealing with "psycho-biologic dynamics" is well written, and for those who desire some well-formulated basis on which to relate neurophysiology with the emotional disorder of anxiety, study of this section can be recommended. It clearly reflects the authors' concept of a psychosomatic unity. Although it cannot be said that the fact of this unity has been proven in this book, the argument is soundly stated and must excite further interest in this direction.

The book is never dull and it is a pleasure to read the lively opinions of two workers who have felt keenly and discussed thoroughly the clinical material afforded in front-line psychiatry.

[1] "A Manual of Tuberculosis, Clinical and Administrative", by E. Ashworth Underwood, M.A., B.Sc., M.D., D.P.H., with an introduction by Professor J. R. Currie, M.A., M.D., F.R.C.P., D.P.H.; Third Edition, largely rewritten; 1945. Edinburgh: E. and S. Livingstone Limited. 7¼" × 5", pp. 538, with many illustrations. Price: 15s., postage 7d.

[2] "Modern Practical Nursing Procedures", by M. K. Doherty, R.R.C., M. B. Sirl and O. I. Ring; Second Edition; 1946. Sydney: Dymock's Book Arcade Limited. 8¼" × 5¼", pp. 528. Price: 14s. 6d.

[1] "War Neuroses", by Roy R. Grinker, Lieutenant-Colonel, M.C., and John P. Spiegel, Major, M.C., Army Air Forces; 1945. Philadelphia, Toronto: The Blakiston Company. 9" × 6", pp. 155. Price: $2.75.

The Medical Journal of Australia

SATURDAY, MAY 4, 1946.

All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

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A HEAVY BLOW TO MEDICAL RESEARCH.

THE sudden announcement that all medical research at the Kanematsu Institute was to cease as from April 1, 1946, by order of the board of Sydney Hospital, which controls the institute, caused feelings of dismay and apprehension in the ranks of the medical profession throughout the Commonwealth. To research workers in medicine it could be nothing but an evil portent. At least one daily newspaper has commented on the event and non-medical persons are asking why a widely known and valued centre of research should cease operations when more attention is being paid to research in every part of the world than ever before. Others who from time to time deplore the departure from Australia for the intellectual centres of Great Britain and America of many of her most gifted scientists, shake their heads and ask: "Is it any wonder?" Others, of more discernment, think of what we may call the security of the work, holding that cessation or even interruption of work may mean irreparable loss to humanity; they also look on such an event in one place as showing that a similar happening may take place in another—that a research worker will never know when his work is likely to be cut short in its prime. These persons hold, and we fear that they speak truly, that a heavy blow has been given to medical research. The occasion clearly cells for some inquiry.

The Kanematsu Institute was established in connexion with Sydney Hospital in the late 1920's by a firm of Japanese merchants to perpetuate the memory of its founder, who had for many years been engaged in trade with Australia. A sum of something like £25,000 was given and was used to build and equip the institute. It was intended that the institute would undertake the routine pathological work of the hospital. It was only later on that a decision was made to add research to the work. This decision was followed by a gift of £4,000 from Lord Nuffield and by one of a similar amount from the Government of New South Wales. To these amounts an annual subsidy of £4,000 was added by the Hospitals Commission of New South Wales. It is important that these facts should be borne in mind in view of subsequent happenings. In the latter end of 1936 Dr. J. C. Eccles, as Director of the Kanematsu Institute, launched its research activities. That work of the greatest value was carried out is recognized far and wide. The investigations were free and independent and not of the type known as directed research to conform with a programme aimed at some immediate utilitarian objective. In other words, it was work of the best type. In another place in this issue Dr. Eccles, now Professor of Physiology in the University of Otago, refers to the appointment of two workers from the Kanematsu Institute to responsible positions in research laboratories in other parts of the world. This would not have happened if the work carried on at the institute had not been of a high order. After the departure of Dr. Eccles (and the reasons for his going as set out in his letter make sorry reading), Dr. A. J. Canny, who had been a member of the staff of the institute, was appointed acting director, the idea presumably being that the appointment of a director should be left until the termination of hostilities. As far as outsiders have been able to tell, all has been well with the institute. Trouble apparently arose when the Hospitals Commission found that the whole of the annual subsidy had not been spent, but that a sum of £9,000 had been allowed to accumulate. The board of Sydney Hospital was given to understand that no further subsidy would be paid until the moneys accumulated from annual subsidies had been spent. Rather than spend this money, the board acted in a way which is most difficult to understand. On March 1, 1946, the acting director received notice from the board that all research activity at the institute would cease on April 1, 1946. The staff engaged on research was dismissed. Mr. R. Lyons, M.Sc., who had been engaged for three years on research connected with the coagulation of blood and whose work, still uncompleted, had attracted attention overseas, was given a month's notice that his services were no longer required. Miss L. E. A. Wright, M.Sc., who was studying the effect of thiouracil on iodine excretion in thyreotoxicosis, could not be dismissed at once because she had been engaged for a period that came to an end in July next. She was, however, informed that her services would not be required after July. The acting director wrote to the board pointing out that closure of the institute would be a very regrettable event and urging that for the time being research should be continued on a restricted basis. He actually drafted a scheme for five years' work in which, by use of the interest on the accumulated funds and some of the corpus, work could be carried on and a substantial sum remain for future activities. When the board refused to accept this suggestion, the acting director felt that nothing remained for him to do but tender his resignation. This he promptly did. At the same time he wrote a letter to the board offering to carry on without remuneration until such time as a successor should be appointed. Clearly he did not wish the welfare of the patients in the hospital to be prejudiced in any way. The correspondence between the acting director and the board dealing with this part of the episode is published in this issue.

These are the facts before which the board of Sydney Hospital stands arraigned. By the board is meant every

individual member of that body. The fateful decision may have been a majority decision. It probably was. But no minority statement has been issued; no public personal disclaimer of responsibility has even been made by any single member of the board. Those in the minority, if there were any, evidently did not think the decision was of much importance. Had they done so, they would probably have preferred not to remain members of a body capable of inflicting such far-reaching damage. The best that can be said for the board, even if it was actuated by reasons of policy not yet disclosed, is that it has acted in a precipitate way and with complete lack of vision. Whether anything can be done to mitigate the damage likely to be caused by this cruel blow is doubtful. Most people who have any insight into medical research—its peculiar nature and the requirements of its nurture—will agree that a board constituted as the board of Sydney Hospital is constituted, is not a suitable body to have control of an institute of medical research. It is to be hoped that the board will make a clear and full statement of the reasons for its action. Even if it is prepared to do this, it should also consent to a full inquiry by an outside body into the whole circumstances of the recent happenings. Dr. Eccles's leter contains some important suggestions in this regard. The National Health and Medical Research Council has apparently had some dealings with the Kanematsu Institute. As the body chiefly concerned with medical research in Australia, it should be prevailed upon to undertake such an inquiry. If an inquiry is made, the terms of reference should be framed in such a way that this Sydney Hospital disaster is covered and that research throughout the Commonwealth is protected against the repetition of such a short-sighted action.

Current Comment.

ANGINA PECTORIS.

THE diagnosis of affections of the myocardium is now more accurate and refined than it used to be, and it is probable that more non-anginal heart disease is correctly diagnosed today. *Angina pectoris* still raises difficult questions, the most important of which concern the patient's safety and comfort. The mechanism of pain production in the heart is traversed again by E. W. Pickering and P. H. Sanderson in an article on *angina pectoris* and tobacco.[1] They consider the usual hypothesis is reasonable, that some substance is set free from the muscle of the heart and accumulates there. Normally this should be removed, but such removal is presumably tardy and incomplete when the limit of the heart's tolerance is reached. As they point out, this explanation is consistent with the experimental data on the production of pain in skeletal muscle. There must, of course, also be a factor of peculiar neural susceptibility to pain in the heart. Dyspnœa may rise to the point of extreme urgency in some persons without true anginal pain being felt. Fortunately, as Libman and others have pointed out, only one such clamant sensation can dominate the field of sensation at one time. These considerations are not academic because they concern treatment. This question has often been raised: If we succeed in preventing anginal pain, do we expose the patient to the risk of damaging his heart by rash overwork? Experience has so far returned a favourable reply—with discretion in the matter of exertion the heart is not in greater peril because its threshold of pain more nearly approaches the normal. Indeed, if this were not so it would be a positive advantage for a patient with coronary sclerosis to have anginal warnings, a view not likely to afford much comfort of mind to the sufferer.

Pickering and Sanderson, in returning to the old subject of tobacco and its bearing on the production of angina, are not convinced by many of the case records in the literature. Though it is generally believed that tobacco can cause disturbances of rhythm and can be responsible for attacks of pain, they feel that the pattern of anginal attacks described as occurring in relation to smoking often does not resemble the true angina of effort. They have studied three patients carefully, and in one case applied the well-known experimental method in which the patient walks up and down a two-step staircase till pain is produced. Although these patients noticed that smoking could produce pain or influence exercise tolerance, the experimental study showed the tolerance to exercise was not *per se* affected by tobacco and that pain occurred only when the pulse rate was sufficiently fast. Nevertheless, the real point is that to prevent anginal attacks the heart rate must be kept down, and even if tobacco seems insecurely established as a contributory cause, reasonable clinical evidence is warrant for its curtailment. It might be interesting to raise the question of the possibility of tobacco enhancing the response of the cardiac nerve endings to the hypothetical pain substance, but this would be difficult to answer. Efforts of various kinds have been made to interrupt the neural path of pain. Occasional success has rewarded the surgical division of the path in the upper sympathetic chain, and more recently an attempt has been made to arrest pain at the thalamic level.

A. S. Freedberg and J. E. F. Riseman record some success from the use of cobra venom.[1] This powerful substance has been found to act as a sedative on the central thalamic mechanism and has been used to relieve the pain of inoperable cancer. Freedberg and Riseman found fourteen cases in the literature in which cobra venom had given good results in the relief of severe anginal pain. They now present a study of twelve patients who have been treated in this way. These were men and women who had been under careful observation for angina or sclerotic origin. They were divided into three groups according to their response to trinitrin. Cobra venom was injected into the deltoid muscle in doses of ten to twenty mouse units, in a volume of one to two millilitres, daily for three to seven days till a therapeutic effect was obtained. An increase in exercise tolerance was obtained varying from 25% to 75%, the degree of improvement not running parallel to the previously observed response to vasodilators. Indeed several patients who had gained no relief from nitroglycerin were benefited by the venom. The electrocardiographic findings after exercise were not altered, even though pain was relieved. Results were only temporary in most cases, and a biweekly maintenance dose was necessary, though in one instance even this did not prevent a return of pain as before. Local pain was felt after the injections, and increase of the dose in a couple of cases caused toxic symptoms, though ten units injected daily produced no untoward symptoms in any case. It may not be a very precious jewel that the cobra, like the toad, "ugly and venomous", wears in his head, but perhaps this work is an encouragement to pursue research in the relief of pain. In *angina pectoris* there are three possible points of attack: to limit the causal exertion and thus to keep down the heart rate, to relieve coronary ischæmia, and to curb the nervous mechanism that registers pain.

THE ULCER PROBLEM.

ORGANIC DYSPEPSIA has become so important nowadays that in speaking of the "ulcer problem" it is perhaps admissible to assume that it will be understood that gastric and duodenal ulcer are intended. As a writer once said in his own defence when referring to "cardiac pain", everyone knew just what he meant. When the

[1] *Clinical Science*, Volume V, 1945, Numbers 3 and 4.

[1] *The New England Journal of Medicine*, October 18, 1945.

Canadian Medical Association last year invited Owen H. Wangensteen, of Minneapolis, to deliver a Listerian oration he chose the subject of gastric and duodenal ulcer, on which he and his co-workers have done much experimental and clinical work.[1] The subject has lent itself well to this approach. In the past difficulties and failures in treatment have often been due to lack of physiological knowledge, as evidenced by the deficiencies in the earlier dietary systems, the embarrassing complications arising after operations on the stomach, the dangers of uncontrolled alkaline therapy, and even greater dangers inherent in a failure to comprehend in full the mental and temperamental factors so important in this syndrome. In seeking and discovering truth in this field surgeons have played a significant part. Wangensteen attempts no general survey of the problem, but concerns himself chiefly with the connexion between the vascular and acid-peptic factors in the genesis of ulcer, and the bearing of this knowledge on the planning of an operation which will protect against recurrent ulcer. Experimental work forms the basis of this oration. In 1940 Code and Varco, of the University of Minnesota, found a new method of investigating the effects of histamine on gastric secretion. They were able to obtain a prolonged effect by implanting histamine with beeswax, and a daily injection of this combination was found to produce ulcer quite regularly in dogs. Not only was this method used to study the effects of steady dosage of histamine on the stomach and duodenum, but the ulcer diathesis could thus be imitated, and thereby assay could be made of the value of various surgical procedures as a protection against recurrent ulcer. This weapon has proved to be of definite value in the hands of this group of workers. Wangensteen recalls that in their earlier work undue stress was laid on the acid factor alone, and states that later and fuller observations have demonstrated the importance of the peptic digestive factor as a persistent augmenter of damage initiated by unneutralized acid. Many physicians have long felt that our outlook on gastric and duodenal ulcer has been narrowed by too great a concentration on this factor of hydrochloric acid. Wangensteen further points out that ulcers can be produced experimentally by a variety of means which fail to increase gastric secretion. The vascular factor is here of importance and has been specially studied. Since the general introduction of the indwelling duodenal tube in the management of cases of threatened post-operative ileus, hæmatemesis, which was once occasionally seen, has virtually disappeared. The significance of the vascular factor in these cases is stressed by the author, and he quotes authorities who also lay emphasis on the part played by thrombotic and embolic processes in the stomach wall. Fat embolism and hæmatemesis are sometimes connected, and gastric and duodenal erosions have been produced experimentally in animals after trauma to bones and the bone marrow. The intravenous injection of fat also occasionally produced gastric erosions in animals, but much more rapidly and frequently if histamine in beeswax was also administered. This combination of vascular and secretory factors is probably important in man, for, example, in causing the bleeding erosions or ulcer which sometimes occur for the first time in the later decades of life. It would certainly be strange for such symptoms to appear in the later years if the acid-peptic factor was the chief determinant in ulcer formation. It is known, of course, that some of the most dangerous bleedings from ulcer are those associated with sclerosis of gastric arteries, and this may at times be of peculiarly local distribution.

The latter half of this article is occupied with a discussion of the variants of resections of the stomach designed to cure and prevent recurrence of gastric and duodenal ulcer. The bugbear of stomal and jejunal ulcer after these operations has been a very real source of worry, and here it is frankly faced, and the reasons are sought for this and other complications of such operations, both on experimental and clinical grounds. Full details are available in the original paper. Here only the conclusions may be summarized. Wangensteen considers that a 75% resection of the stomach, carried out on the Billroth II plan, will meet the requirements of a satisfactory operation for ulcer, provided that a short afferent duodenal loop is used. The antral mucosa and the lesser curvature are excised. He suggests that the intractable ulcer may be a myth. Partial gastrectomy is no light hazard, even for those in whom other measures have failed, and it is certainly desirable that patients subjected to it should be comfortably sure of not running the risk of suffering from a late sequel such as a severe anæmia on the one hand, or on the other hand that of further hæmorrhage or perforation.

[1] *The Canadian Medical Association Journal*, October, 1945.

THE MEDICAL HISTORY OF THE WAR OF 1939–1945.

APPROVAL has been given to the general plan for the "Medical History" of the recent war. It is proposed that it shall consist of four volumes whose total content will not be greater than that of the three volume medical history of the last war. The scope of the history includes the work of the medical services in the navy, army and air force, and medical conditions in the civil community.

Two volumes will deal with medical aspects of the history of pre-war organizations and preparations for mobilization, Middle East campaigns, the defence of Australia, Malaya and Netherlands East Indies, and the South-West Pacific Area. In the main, a chronological order will be followed. Another volume will contain an account of the medical services of the Royal Australian Navy and the Royal Australian Air Force. Special articles will deal with technical subjects peculiar to these services, particularly in relation to Australian work and experience. The fourth volume will be devoted to the preventive and clinical aspects of war medicine and surgery. Some articles will be specially contributed for this volume, but it is also planned to use material from many sources and from all services so that the experiences and views described may be truly representative. The influence of war experience on civil medical practice will be borne in mind in the compilation of this clinical section.

In general, the material for a medical history is derived from archives (war diaries and appendices), other special reports and personal communications. It would be of the greatest assistance to the editor of the "Medical History" if individual medical officers could make available to him any relevant material from diaries, accounts of personal experiences or clinical records. The greater the number of participants in a national work like a history, the greater will be the accuracy and fullness of the record. Cooperation would be welcomed not only from those who have been specifically asked to supply material, but from others who have perhaps from motives of personal modesty not considered making offers of assistance. The office of the Medical Historian is c.o. D.D.M.S., Victoria Barracks, Sydney.

AN INTERNATIONAL MEDICAL CONFERENCE.

A CONFERENCE to be held in London on September 25 to 27, 1946, is being convened by the British Medical Association on behalf of the *Association professionnelle internationale des médecins* for the purpose of considering means of promoting closer ties among the medical organizations in the different countries. The Federal Council has been invited to send one or two representatives. Before the war the "A.P.I.M." was the only body providing international medical contact in matters of professional and medico-social interest. A broader sphere of activity is now thought to be needed. It is hoped that a new organization will (*a*) undertake an exchange of information on medical affairs, (*b*) promote closer ties among national medical organizations, (*c*) encourage better international relations generally, (*d*) embody, continue and extend the work formerly undertaken by the "A.P.I.M.". It is to be hoped that the Federal Council will be suitably represented, if not by someone sent from the Commonwealth, by an Australian resident in England.

Abstracts from Medical Literature.

GYNÆCOLOGY.

Surgical Obstruction of the Fallopian Tube.

E. G. KRIEG (*Surgery, Gynecology and Obstetrics*, September, 1945) refers to the disturbing number of failures in surgical obstruction of the Fallopian tube recorded by various investigators. He has experimented upon bitches to discover a satisfactory method of achieving permanent obstruction of the tube. The author states that for experimental purposes the structure of the cornua of medium-sized bitches compared favourably with the human salpinx; the outstanding exception was the mucous membrane layer. He believes that the endometrium in the bitch should have resisted to a greater degree procedures designed to produce stenosis than would the mucous membrane of the Fallopian tube. After describing in detail the method employed in the experiment, the author states the following conclusions: (i) Adequate trauma must involve the mucous membrane layer in order to produce stenosis of the cornua in the dog. (ii) When physical trauma was induced by crushing, the degree obtained was difficult to gauge. (iii) The addition of chemical trauma produced a satisfactory result in all experiments. (iv) The sclerosing solution must be adequate. Carnoy's solution and a 75% solution of phenol were satisfactory. (v) Failure occurring after the original technique of Madleiner may be due to the following causes: (a) absorbable suture material does not remain in place for sufficiently long; (b) simple tying without preliminary crushing does not sufficiently traumatize the mucosa; (c) rapid crushing may cause shearing with resultant fistula formation; (d) the presence of heavy cornual musculature during pregnancy or œstrus may lead to incomplete crushing.

Basal Body Temperature Graphs as an Index to Ovulation.

PENDLETON TOMPKINS (*The Journal of Obstetrics and Gynæcology of the British Empire*, June, 1945) advocates the use of daily temperature readings as a method of ascertaining the time of ovulation. He maintains that the basal temperature in women consistently shows a drop followed by a rise about fourteen days before the onset of menstruation. The rise is then maintained until menstruation begins. The author recommends this method as the simplest and most accurate way of timing ovulation for an individual woman. To obtain a basal temperature reading it is suggested that it be taken *per rectum* in bed before rising each morning. The patient is instructed to keep a chart of the daily readings, noting any intervening conditions, such as sore throat, which may cause a rise in temperature. Using such charts as an index of ovulation, the author was able to predict the time of maximal fertility for those who wish to conceive. Obviously this occurs immediately after the temperature shift takes place. These charts are equally valuable for ascertaining the "unsafe" period for those who do not use contraceptives, but have no wish to conceive, especially when there is irregularity of periods. When pregnancy supervenes the ovulatory temperature rise is uniformly maintained, so that this observation, coupled with amenorrhœa, is a suggestive sign of early pregnancy—"the poor man's Friedman test". Other uses to which these charts may be put include the evaluation of treatment intended to stimulate ovulation, as an aid in securing biopsies in the pre-ovulatory or post-ovulatory phases of the endometrium, in studying the effectiveness of contraceptives, and as a means of investigating some types of irregular uterine bleeding.

Vaginal Hæmorrhage in Women Aged over Forty Years.

R. W. NOYES (*The Western Journal of Surgery, Obstetrics and Gynecology*, October, 1945) has studied vaginal hæmorrhage in women over the age of forty years, in order to determine the relative importance of the menopause and of chronological age in the differential diagnosis of causes of irregular vaginal bleeding. The clinical material consisted of 415 women; 190 had passed the menopause. The author found that the presence or absence of the menopause was of more importance than the chronological age in determining the probable cause of the hæmorrhage. He believes that education about cancer is causing women in this age period to seek medical advice about irregular vaginal hæmorrhage more than before. In the series under review, cancer of the cervix was the cause of the hæmorrhage twice as frequently as cancer of the fundus. Benign lesions of the cervix and vagina included senile vaginitis, cervicitis and erosion, cervical polypi, prolapsed uterus and urethral caruncle. Benign conditions of the uterus included myomata, endometrial polypi, endometritis, incomplete shedding, œstrogen withdrawal and hyperplasia of endometrium. It was found that hæmorrhage from benign lesions of the cervix and vagina began longer after the menopause than that due to benign uterine lesions. In 15% of premenopausal patients and 7% of post-menopausal patients no cause for the hæmorrhage could be found. Hæmorrhage due to œstrogen withdrawal occurred in 23 cases, mostly among post-menopausal women. In one-half of the cases surgical and pathological studies were required to make the diagnosis, in addition to the history and clinical examination.

Theca-Cell Tumours of the Ovary.

E. A. BANNER AND M. B. DOCKERTY (*Surgery, Gynecology and Obstetrics*, September, 1945) present a study of theca-cell tumours of the ovary. The material consisted of 23 tumours, selected from more than 600 solid and semisolid ovarian tumours examined in the division of surgical pathology and the section on pathological anatomy of the Mayo Clinic between the years 1910 and 1944, inclusive. All the material had been preserved in a 10% solution of formalin (4% formaldehyde). The clinical records of the patients from whom the specimens had been removed were investigated, and pathological and chemical studies were made. Twenty patients were traced and follow-up investigations were carried out. No patient in this group had died as the result of a malignant process beginning in a theca-cell tumour. In one case a small theca-cell tumour was observed incidentally at autopsy. The authors state that the tumours appear to be derived from the ovarian mesenchyma and are closely related to the granulosa-cell group of tumours. Occasionally the relationship may be histological, elements of both types being discernible in the same neoplasm. Usually, however, both tumours are of pure type. The relatively high incidence, especially in patients past the menopause, of associated myometrial hypertrophy and uterine fibromyomata, combined frequently with endometrial hyperplasia and cervical and fundal carcinoma, suggests that œstrogenic hormone is produced by the ovarian tumours. The fact that assays of tumour tissue failed to demonstrate the presence of measurable quantities of this hormone is not necessarily conclusive evidence of absence of the hormone. Chemical analysis of eight theca-cell tumours showed that these tumours contained increased amounts of cholesterol and cholesterol ester fractions in comparison with the values found in seven normal ovaries. Although the tumours did not always produce clear-cut clinical symptoms, their presence could often be suspected from an alteration in the patient's mentrual habits. Post-menopausal hæmorrhage from a hypertropic endometrium was commonly encountered. On the histological side difficulty was encountered in distinguishing certain fatty fibromyomata from theca-cell tumours. In such cases, examination of the endometrium was often of value.

Granulosa-Cell Tumour of the Ovary.

JANE E. HODGSON, M. B. DOCKERTY AND R. D. MUSSEY (*Surgery, Gynecology and Obstetrics*, December, 1945) present a clinical and pathological study of 62 cases of granulosa-cell tumour of the ovary, which occurred at the Mayo Clinic between 1910 and 1944. The incidence was 1·63% of 3,800 ovarian tumours discovered during the same period. About 60% of the granulosa-cell tumours were found in women who had passed the menopause. The commonest clinical symptoms were uterine hæmorrhage, amenorrhœa and abdominal enlargement. It was apparent from the records that the tumours grew slowly and might have been present for as long as thirty-five years. The authors recommend the performance of assays of the amount of œstrogen in the blood and urine before and after operation, both to widen the present knowledge of the excretion of œstrogen and to aid in the clinical diagnosis. Evidence of hyperœstrinism in the present series was provided by symptoms of precocious puberty, amenorrhœa and post-menopausal hæmorrhage; it was supported by the incidence of adenomyosis and endometriosis, which often occurred in post-menopausal patients, of uterine fibromyomata, of uterine hypertrophy and of proliferative endometrium. Evidence was also present that granulosa-cell tumours might possibly produce the differentiative hormone, progesterone; the authors think that efforts should be made to obtain biological proof of this phenomenon. A high incidence of endometrial carcinoma was found in the post-menopausal patients. In three of the eight cases in which this

occurred, carcinoma of the breast with axillary metastases also developed. The authors point out that this coexistence of ovarian, endometrial and mammary carcinoma in the human being bears a resemblance to the results of experiments on animals, in which œstrogen stimulation appears to be a factor in carcinogenesis. The granulosa-cell tumours appeared to be of a low order of malignancy. They conformed to well-established patterns, and there was a high incidence of luteinization and of admixture of granulosa and theca cells. Chemical analysis of four of the tumours indicated an excess of cholesterol and cholesterol esters as compared with the ovaries. This increase in lipoid content was thought to be related to storage of œstrogenic hormone. By contrast, in the present series the phospholipid content of the tumours was surprisingly low. Yet analysis of luteinized portions revealed increased amounts of both substances. In the group of 62 cases of granulosa-cell tumour, there were four recurrences and one possible recurrence. Poor results were considered to be due to conservative surgical procedures among post-menopausal patients. The authors hold that for women past middle life affected by these tumours, bilateral oophorectomy and hysterectomy are advisable; less radical procedures are required for younger women. The authors are unable to say whether irradiation therapy, either before or after operation on post-menopausal patients, is of value.

OBSTETRICS.

The Conservative Management of Placenta Prævia.

HERMAN W. JOHNSON (*American Journal of Obstetrics and Gynecology*, September, 1945) stresses the fact that the initial episode of hæmorrhage in a case of *placenta prævia* is never fatal. He strongly advises against drastic treatment at this stage. He maintains that the high fœtal mortality rate in *placenta prævia* cannot be reduced unless the pregnancy is allowed to proceed to the period of viability of the fœtus, and until the practice of using the body of the fœtus as a mechanical tampon is discontinued. Accurate diagnosis is essential, and careful vaginal examination with aseptic precautions is advocated, provided facilities exist for dealing with emergencies. X-ray examination is also helpful. The hæmorrhage in *placenta prævia*, unless the placenta is central, is due to separation of the placenta brought about by dilatation of the cervix. Therefore during labour the hæmorrhage is intermittent, allowing intervals for natural and transfusion replacement of blood. Because of this fact it seems reasonable not to rush the delivery or to interfere with the normal progress of labour, except possibly to rupture the membranes, to apply "low forceps" or to extract a breech after full cervical dilatation. Cæsarean section has its place; the author recommends it in all cases of central *placenta prævia*, and probably, in the interest of the baby, in practically all cases of *placenta prævia* in *primiparæ*. The anæsthesia should be as light and short as possible, and a safe time should be chosen for operation; that is, the blood pressure should be sufficiently high to withstand the sudden additional loss of blood following separation of the placenta. In all cases of suspected *placenta prævia* the patient should be admitted to hospital for accurate diagnosis and for close observation of a developing anæmia. The only justification for termination of pregnancy before viability of the fœtus is the development of anæmia of such severity that further hæmorrhage would endanger the life of the mother. In cases in which Cæsarean section is not recommended, the author maintains that if the membranes are ruptured artificially, the presenting pole of the fœtus aids dilatation and acts as a natural tampon. In addition, the escape of amniotic fluid decreases the intrauterine volume and permits of at least a certain amount of retraction in the lower uterine segment. Transfusion facilities must, of course, be available. It is also advised that, after the second stage is completed, no effort should be made to hasten separation of placental tissue which remains attached, even if free hæmorrhage is occurring. No blood is escaping from unabrupted utero-placental sinuses, and the provision of a fresh source of hæmorrhage may be the determining factor in the outcome.

Late Toxæmia of Pregnancy.

H. F. DYER (*The Canadian Medical Association Journal*, July, 1945) introduces a method for detecting the onset of toxæmia of pregnancy in its early stages, and recommends the intake of fruit juices, both as a prophylactic measure and as a curative measure, in these early stages. He maintains that spasm of the renal vessels plays a major role in the causation of toxæmia, and points out the advantage of diagnosing the condition while this spasm is still only functional. He quotes the statement of Best and Taylor that the first sign of kidney disease is when the volume of urine excreted at night approaches or even exceeds that excreted during the day. At their first visit he orders his pregnant patients to take 100 ounces of fluid a day between 8 a.m. and 8 p.m. They are then instructed to measure in ounces the volume of urine excreted in a period of twenty-four hours each week. The "day urine" is that excreted between 8 a.m. and 8 p.m., and the "night urine" is that excreted between 8 p.m. and 8 a.m. When the kidneys are functioning normally, the ratio of the day urine to the night urine should be as two or three to one. In cases in which toxæmia will develop, there is a pronounced change in the kidney function. In one group of these cases the total volume of urine excreted in a period of twenty-four hours was increased; but the ratio changed so that the night urine volume came to equal or even to exceed the day urine volume. In another group there was a decrease in the total volume of urine excreted. In severe cases this decrease is so sudden that before it is noticed a condition almost equivalent to anuria occurs, which is accompanied by the appearance of hypertension and albuminuria. Increased gain in weight and œdema of the feet and legs, however, usually appear at about the same time as the initial change in kidney function. When the early signs of toxæmia are established in this way, the author has made a practice of substituting 40 ounces of fruit juice for 40 ounces of fluid per day, the total daily intake of fluid remaining at 100 ounces. On this revised scheme of fluid intake the kidney function is usually restored to normal in five to seven days. The œdema disappears and weight is lost. If the toxæmia has developed to a point at which later signs of hypertension and albuminuria are present, the fruit juices are not nearly so effective, and in many cases they are of doubtful value. In a fulminating case, however, they are useful in establishing an improved flow of urine while other measures, such as induction of labour, are being considered.

The Effect on Infant Mortality of Vitamin K Administered during Labour.

EDITH L. POTTER (*American Journal of Obstetrics and Gynecology*, September, 1945) gives a review of the literature concerning the effect of vitamin *K* in reducing the incidence and mortality of hæmorrhagic disease of the newborn. This review is followed by a report on 13,190 infants born at the Chicago Lying-In Hospital from January 1, 1941, to November 1, 1944. The author concludes that in the majority of infants the prothrombin time is prolonged during the greater part of the first week of life. Vitamin *K* given to the mother prior to delivery or to the infant after birth will usually prevent this prolongation. It will also cause a return to normal after the prolongation has once occurred. She maintains, however, that there is no proof that prolongation of prothrombin time is a direct cause of hæmorrhage. Many infants with excessively long prothrombin time show no evidence of hæmorrhage, while others with relatively little prolongation of prothrombin time suffer severe hæmorrhage. The optimistic prophecies which were made earlier in regard to the value of routine administration of vitamin *K* in preventing hæmorrhage and reducing neonatal mortality rates do not seem to have been justified. The present study indicates that true hæmorrhagic disease, in cases in which there is no suspicion of trauma, is extremely rare, and that the incidence of the hæmorrhages which do occur in this age group is not modified by the administration of vitamin *K* to the mother prior to delivery or to the infant after birth. In this study 6,560 infants weighing over 1,000 grammes were born during the first two years, and all the mothers received vitamin *K* during labour. During the next twenty-two months no vitamin *K* was given, and 6,630 babies were born. The total fœtal and infant mortality rate of 29·8 per 1,000 births for the first two years is higher than that of 25·8 for the last two years, in spite of the fact that no significant change occurred in the incidence of primiparity, premature delivery, mode of delivery or other known factors. The mortality rates for live-born infants are identical in the two series, as also are the numbers of infants who showed evidence of hæmorrhage at autopsy. Of the whole series of 13,190 infants, only two showed evidence of true hæmorrhagic disease, and both of these babies died in spite of receiving vitamin *K*. The author concludes therefore that no decrease in infant or fœtal mortality can be expected to result from the routine administration of vitamin *K* to all women during labour.

British Medical Association News.

ANNUAL MEETING.

THE annual meeting of the Tasmanian Branch of the British Medical Association was held at the Tasmanian Museum, Hobart, on March 2, 1946, DR. G. M. W. CLEMONS, the President, in the chair.

Annual Report of the Council.

The annual report of the Council for the previous year was read and adopted. The report is as follows.

The membership of the Branch, which was 127 at the beginning of 1945, was 124 at the beginning of 1946. Eleven new members have been elected, five have been transferred from other Branches, and two have resumed membership through payment of an overdue subscription; while one member has died, one has resigned, nine have transferred to other Branches; and ten allowed their membership to lapse. Six out of these ten have resumed their membership since the beginning of the year.

Six ordinary and two special meetings of the Branch have been held since the last annual meeting, the average attendance being 16·9.

Papers have been read by Dr. Goddard, Dr. Reid and Captain Stegmann; cases have been demonstrated by Dr. Tremayne, Dr. Dorney, Dr. Stretton, Dr. Muir, Dr. Magner, Dr. T. Butler, Dr. Kelly, Dr. Millar, Dr. Duncan and Dr. W. Freeman; and two films have been shown. The Branch has also been privileged to hear addresses from Surgeon Rear Admiral Gordon Taylor and Surgeon Captain Lambert Rogers.

Twelve meetings of the Branch Council have been held, the attendances being as follows: Dr. Clemons (7), Dr. Goddard (7), Dr. T. Giblin (9), Dr. Reid (10), Dr. Craig (7), Dr. Holman (8), Dr. Crowther (9), Dr. Hiller (10). Dr. Grove (6), Dr. Millar (9), Dr. Walch (12).

The Branch has been represented on the Federal Council by Dr. J. S. Reid and Dr. C. Craig, on the State Medical Coordination Committee by Dr. W. Giblin, and on the State Profession Committee on Post-War Reconstruction by Dr. T. Giblin and Dr. J. Walch.

The following committees have been appointed:

Ethics Committee: Dr. Millar, Dr. Goddard, Dr. Craig, Dr. Reid, Dr. T. Giblin and Dr. Holman, with the President and Secretary.

Lodge Agreement Committee: Dr. J. Rail Robertson (chairman), Dr. Goddard, Dr. Harris, Dr. Turnbull, Dr. Abbott and Dr. Kelly.

Local Committee of Management for Federal Medical War Relief Fund: Dr. S. Gibson, Dr. J. A. Gollan and Dr. T. Giblin.

Committee on Reestablishment of Ex-Service Medical Officers: Dr. Fay, Dr. Clemons and Dr. Grove.

Committee on Petrol and Linen Rationing: Dr. Hiller, Dr. Duncombe and Dr. J. Walch.

Financial Statement.

The financial statement, which had been circulated among members, was taken as read and adopted.

Election of Office-Bearers.

Dr. J. Grove was elected to the office of president-elect. Dr. G. M. W. Clemons was elected a member of Council. No nominations having been received, the position of vice-president and that of two members of Council were declared vacant. Dr. J. P. Millar was elected acting honorary treasurer for a period of one month. Dr. J. H. B. Walch was elected acting honorary secretary for a period of one month.

A recommendation of a subcommittee of the Council that an honorary medical secretary and a part-time lay secretary should be appointed was accepted. The appointment of a lay secretary was left in the hands of the Council.

Induction of President.

Dr. G. M. W. Clemons inducted Dr. T. H. Goddard to the office of president and vacated the chair in his favour. Dr. Goddard thanked the members for his election.

Retiring President's Address.

Dr. G. M. W. Clemons read his retiring president's address (see page 669).

NOTICE.

THE General Secretary of the Federal Council of the British Medical Association in Australia has announced that the following medical practitioners have been released from full-time duty with His Majesty's Forces and have resumed civil practice as from the dates mentioned:

Dr. J. L. Watt, 448, Peel Street, Tamworth, New South Wales (February 19, 1946).

Dr. V. G. Bulteau, 143, Macquarie Street, Sydney (April 8, 1946).

Dr. K. B. Fraser, Ballow Chambers, Wickham Terrace, Brisbane (April 15, 1946).

Dr. J. R. Hutcheon, Ballow Chambers, Wickham Terrace, Brisbane (April 10, 1946).

Dr. K. C. T. Rawle, 51, Anson Street, Orange (April 15, 1946).

Dr. J. S. Crakanthorp, 14, McMahon Street, Hurstville (April 1, 1946).

Medical Societies.

MELBOURNE PÆDIATRIC SOCIETY.

A MEETING of the Melbourne Pædiatric Society was held on November 14, 1945, at the Children's Hospital, Carlton, Melbourne, DR. ERIC PRICE, the chairman, in the chair.

Poliomyelitis.

Pathology and Pathogenesis.

DR. REGINALD WEBSTER, in opening the discussion, said that since the severe epidemic of poliomyelitis in Victoria in 1937, at which period the subject was discussed at a meeting of the society, much new work had emanated from authoritative sources to disturb, if not dispel, tenets and teaching then firmly held and confidently promulgated. New facts in the natural history of the disease had profoundly modified conceptions regarding the mode of infection, the distribution of the virus in the body, its path of exit, and the channels and vehicles of its dissemination. Finality could not yet be said to have been reached on those important aspects of the disease, and from the epidemiological point of view the subject of poliomyelitis was again in the melting-pot of speculation and research. While this was so, the essential lesions of the disease had not altered, though they had been demonstrated more frequently in the higher reaches of the central nervous system than they were formerly recorded as having occurred. Dr. Webster said that the photomicrographs which he proposed to show as demonstrating the histopathology of poliomyelitis were as valid as on the day of their preparation. Some of the slides derived from exerimental poliomyelitis which he had induced in monkeys in 1918, and others from children who had died in the Children's Hospital, Melbourne, in the epidemic of 1937.

Dr. Webster went on to say that the several types of lesion which he would describe as covering the whole field of the morbid histology of poliomyelitis might be considered under the following heads: (i) perivascular changes, (ii) diffuse interstitial inflammatory reaction, (iii) focal inflammatory reaction, (iv) all degrees of damage to nerve cells, (v) changes in the posterior root ganglia, (vi) meningeal reaction. Dr. Webster demonstrated these lesions by means of slides.

Dr. Webster then discussed perivascular cell collarettes. He said that perivascular cell aggregations were perhaps the most striking and obvious histological features in a section of spinal cord reacting to the virus of poliomyelitis, but the degree of prominence they assumed was not a measure of their diagnostic significance. They were merely the expression of a non-specific inflammatory reaction in the central nervous system, and were just as much a feature of epidemic encephalitis, rabies and post-vaccinal encephalitis as of poliomyelitis. In another slide, under higher magnification, it was seen how the aggregated inflammatory cells distended the vascular adventitial spaces and appeared to dissect the adventitia of the vessel into its component layers. The cells were mainly lymphocytes, with a small proportion of polymorphonuclear leucocytes and plasma cells; they were most probably derived from the circulating blood.

The next two slides shown by Dr. Webster illustrated the interstitial inflammatory reaction as it appeared in the two forms commonly observed—namely, diffuse cellular infiltration and defined focal collections. The focal collections were

of special significance, for they were said never to be seen in epidemic encephalitis. Many of the cells might be polymorphonuclear leucocytes—another distinguishing point in the histology of poliomyelitis and of epidemic encephalitis. By ordinary staining the inflammatory cells appeared to be of lymphoid type; but by the silver carbonate technique the bulk of the diffuse and focal exudate had been found to consist of microglia, the Hortega cells, notable as the essential scavengers of the central nervous system.

Discussing the damage inflicted on nerve cells, Dr. Webster said that the view had been advanced by keen observers in the past, and was supported by no less an authority than A. B. Sabin (*The Journal of the American Medical Association*, Volume CXX, 1942, page 506) in the present, that the inflammatory changes which were so conspicuous in the photomicrographs he had shown up to this point were concomitant only, and the result of the essential lesion rather than its cause. In other words, what Sabin had termed the "pathological unit" in poliomyelitis was neuronal damage and destruction, upon which supervened the reactive inflammatory process. Certain it was that the degenerative and necrotic changes appeared in affected ganglion cells with a rapidity which conduced to a belief that the neurones were the objects of immediate and primary attack by the virus. This belief was supported by the study of experimental poliomyelitis, in which significant damage to nerve cells had been observed in animals killed in the pre-paralytic stage, and in a recent article by Sabin there had appeared photomicrographs which revealed an astonishing degree of nerve-cell damage in the cords of monkeys killed shortly after spontaneous recovery from transitory poliomyelitic paralysis. The changes in the nerve cells consisted of poor staining, loss of Nissl granules, eccentricity of the nucleus and swelling of the axis cylinder, and they were frequently so severe as to culminate in total destruction and disappearance of the cell. The dead cells became surrounded and invaded by phagocytes, a phenomenon known as neuronophagia. The process of neuronophagia was effected by those amœboid and phagocytic derivatives of the microglia known as Hortega cells, although polymorphonuclear cells also played a part. As he had already indicated, the process of cell death might be very rapid, and in the study of experimental poliomyelitis it had been found that twenty-four hours made all the difference between the appearance of early lesions in the nerve cells and the cells' conversion into a necrotic mass of debris. The fact that the intensity of changes in the nerve cells bore no relation to the severity of the vascular lesions was a strong point made by those who contended that the death of the cells was not a secondary effect of the vascular lesions, but was due to a direct attack of the virus upon the cells themselves.

Dr. Webster emphasized that lesions in the posterior root ganglia were very constant. They were in all respects the same as those occurring in the spinal grey matter—degeneration and necrosis of ganglion cells, collections of inflammatory cells, and neuronophagia. The inflammatory reaction in the posterior root ganglia appeared to supply an anatomical basis for the hyperæsthesia which he understood was a frequent clinical observation in poliomyelitis. It seemed remarkable, in view of the striking and unequivocal character of the lesions in the dorsal root ganglia, that so little objective sensory loss could be demonstrated clinically. The suggestion had been made that the "spine sign" was referable to traction on the inflamed roots and ganglia.

Dr. Webster then showed a slide, to one feature of which he drew particular attention; this feature was one which it had in common with a former slide prepared from the lumbar cord of a monkey; it was the irregular incidence of the virus's attack on the ganglion cells, and the presence of apparently intact cells among others exhibiting all gradations of degeneration and obsolescence to total necrosis and elimination. In this feature of the morbid histology of poliomyelitis might be found the basis for the mild and transitory nature of some of the paralyses, and the explanation of the measure of recovery often observed after severe paralysis. Mild and transitory paralysis had been studied in monkeys inoculated with virus strains of recent human origin and therefore not adapted to the monkey and of relatively low virulence for the species. Under such conditions it frequently happened that the depredations of the virus were limited to an extent which fell short of the destruction of a sufficient number of nerve cells to produce paralysis. It had also become evident that monkeys did not need all their anterior horn nerve cells for apparently normal function. Sabin had published remarkable photomicrographs of the lumbar cords of two monkeys in which non-paralytic poliomyelitis and evanescent paralysis had been respectively induced. In both instances a surprising amount of nerve-cell damage in the anterior and lateral horns was accompanied by considerable focal and diffuse cellular infiltration. It seemed probable that in many instances the segmental distribution of the lesions might be patchy, allowing a sufficient number of neurones to escape to maintain the major innervation of a given muscle. Dr. Webster considered that it was not too imaginative to assume that the virus did not inevitably destroy all affected neurones, and that some of the partially degenerated cells might not be afflicted beyond their powers of recovery.

Discussing the meningeal reaction, Dr. Webster said that it had been customary to attribute the high cell counts in the cerebro-spinal fluid in the early stages of the disease to an early meningeal lesion; but the distension of the vascular adventitial spaces by the cells of the perivascular collarettes showed a possibility of entry of cells to the cerebro-spinal fluid quite independent of meningeal inflammation. Should the cells spill over into the perivascular lymph spaces, they gained access to the cerebro-spinal fluid. The perivascular lymph spaces were formed by prolongations of the pia-arachnoid along the sheaths of the vessels entering the cord, and a communication had been demonstrated between the perivascular lymph spaces and the Virchow-Robin spaces in the adventitia. In the view of those who regarded the interstitial and perivascular infiltration with cells as secondary to neuronal damage, the cells present in the meninges actually represented an overflow from the perivascular spaces rather than true meningitis.

Dr. Webster went on to say that, although the lesions in the anterior cornua of the spinal cord monopolized attention in the early history of the disease, it was now generally appreciated that the posterior horns did not escape, as was evident from the changes prone to occur in the cells of Clark's column, situated at the base of the posterior horn. As had been indicated, the dorsal root ganglia were constantly implicated. It was formerly taught that the lesions of poliomyelitis might be found anywhere in the spinal cord, from the sacral region to the mid-brain; but that they seldom extended higher, and for many years the spinal cord and medulla seemed to command the whole attention of neuropathologists. Studies directed to the higher levels of the central nervous system in recent years had established the fact that the motor cortex was not infrequently affected, particularly in the region of the precentral gyrus, designated as Area IV in Brodmann's map of the cerebral cortex. Recognition of the fact that lesions were almost regularly present in the vestibular nuclei of the medulla, the roof nuclei (fastigius and dentatus) and the vermis of the cerebellum, as well as in the motor cortex, was of first importance for a proper appreciation of the disturbances of muscle function of poliomyelitis. Area IV of Brodmann was defined as "the centre from which the impulses initiating voluntary movements on the opposite side of the body descend to the motor nuclei of the cerebro-spinal nerves". The involvement of this area (precentral gyrus), and especially the layer of Betz cells within it, suggested that with regard to certain muscle groups, the upper motor neurones concerned in initiating voluntary movements might be affected to a significant degree.

Dr. Webster then said that some consideration was now due to the portal of entry of the virus and its distribution in the body generally. Ten years earlier the path of infection seemed to present no problem, there being general agreement that the virus made its entrance and its exit by the nose, and that poliomyelitis was to be placed in the category of upper respiratory tract infections. At the time of the very serious epidemic in Victoria in 1937, the doctrine of invasion and spread by neural pathways—the so-called "axonal spread"—had been so well promulgated that it had largely displaced the conception of a systemic phase followed by localization of the virus in susceptible neurones. Spread by neural pathways was still strongly advocated, although it was admitted by the exponents of that school that the hyperplasia which affected the lymphoid tissue throughout the body was as yet "poorly understood". The present position, however, was that the complacency in what was thought to be knowledge concerning the path of infection by the virus and the mode of transmission of the disease, had been dissipated by the convincing studies which had demonstrated the virus in the whole length of the alimentary tract and in the intestinal contents. Conspicuous workers in this field had been A. B. Sabin and R. Ward (*The Journal of Bone and Joint Surgery*, Volume XLII, 1944, page 829), and Sabin had shown by the examination of twenty-two different tissues from each of seven human subjects of poliomyelitis that the virus was found predominantly in two systems: (i) certain portions of the nervous system and (ii) the alimentary tract. In these studies the absence of

the virus from the olfactory bulbs and associated rhinencephalic centres and from the nasal mucosa, indicated that contrary to common belief the olfactory pathway was not the usual portal of entry for the virus. The almost regular presence of the virus in the walls of the pharynx or ileum, or in the intestinal contents, and its absence from most of the other tissues examined, suggested that the alimentary tract might provide the site of primary attack and invasion. Tests by Ward and Sabin on various levels of the alimentary tract disclosed the virus in washed portions of the tongue, the posterior pharyngeal wall, the duodenum, and various levels of the small and large intestine. In parenthesis, Dr. Webster said that he had been amazed by the facility and regularity with which the virus of poliomyelitis had been demonstrated in the fæces, not only of subjects of the disease, but of household contacts of such patients. The lines of advance of the virus from the alimentary tract were held to be by neural pathways, and it had been maintained that the distribution of lesions in the nervous system in human beings and laboratory animals did not correspond with that to be anticipated from spread by blood vessels or dissemination by the cerebro-spinal fluid. It was an interesting and probably significant point that the virus had never been demonstrated in the cerebro-spinal fluid.

Much evidence had been assembled to show that the part of the central nervous system first to be attacked was determined by the neural connexions of the peripheral tissues from which the virus invaded, and that the subsequent spread within the nervous system was dependent on the central connexions of the neurones in which the greatest proliferation of the virus occurred. On this view, primary bulbar poliomyelitis was affected by invasion of the virus along the fifth, seventh, ninth and tenth cranial nerves from the upper part of the alimentary tract. When paralysis affected initially the lower extremities, the intercostal muscles or the muscles of the upper limbs, the visceral afferent fibres from the intestine were held to provide the pathway by which the virus gained the central nervous system via the posterior root ganglia.

In conclusion, Dr. Webster observed that the epidemiological significance of the facts established with regard to the constant presence of the virus in the fæces of subjects of poliomyelitis and many of their contacts was far-reaching and profound. Time did not permit him to deal adequately with the interesting subject of dissemination of poliomyelitis. In no less than twelve epidemics, and by different workers, the virus had been demonstrated in sewage; it had been detected in flies—both rural flies which frequented open latrines and flies of modern urban districts. In one laboratory, virus was demonstrated in eight out of fifteen batches of flies tested. One group of workers in Sweden had claimed to have detected the virus in drinking water; but most of the evidence available pointed away from drinking water as a vehicle of dissemination. The analysis of the Broadstairs and Ramsgate epidemic by Aycock in England in 1926 was suggestive with regard to milk; but the more one read on dissemination of poliomyelitis, the more complex the problem became. Fæces, sewage and flies seemed strong links in a chain of infection, but the links did not become a chain until they were forged together. It was not at all clear how virus might travel, if indeed it ever did so, from contaminated sewage to the susceptible human being. No one with experience of the Victorian epidemic of 1937 would deny some part to contact infection, and the possibility of contact infection might be said to have been reaffirmed by the demonstration of virus by Howe and his colleagues in swabbings from the oral pharynx of seven out of fourteen patients affected with poliomyelitis. Salivary contamination must therefore occur, with the possibility of droplet infection. In the light of present-day knowledge, however, there could be no question that the chief mode of elimination of the virus was by the stools. This being so, the post-mortem evidence for the human alimentary tract as a portal of entry, and the finding of abundant virus in stools, sewage and flies, suggested strongly that poliomyelitis should be regarded at least provisionally as one of the excremental infective diseases, even as dysentery and typhoid fever.

The Virus of Poliomyelitis.

DR. G. ANDERSON said that he had been asked to discuss viruses in general and the virus of poliomyelitis in particular. Viruses might be defined and distinguished from bacteria by their small size, being less than 0·3μ in diameter, and by their inability to reproduce themselves in any medium other than living tissue. Because of their small diameter they passed through filters capable of retaining bacteria, and were invisible as single organisms when an oil immersion microscope was used. However, the recent production of the electron microscope had enabled most viruses to be photographed, and there was some suggestion that the virus of poliomyelitis, among the smallest of viruses, might be of a slender rod shape.

Most, if not all, forms of life required to be provided with enzymes of some type for their growth and reproduction; but whereas the provision of such isolated enzymes was sufficient to enable the metabolism of bacteria to proceed, viruses required to be provided with enzyme systems already functioning—in other words, viruses could metabolize only as an integral part of another cell; they therefore reproduced themselves only in or on living cells and formed part of the host cell's physiological economy. According to the form of the relationship between host cell and virus, the cell might or might not die. In this regard it might be noted that chemotherapy aimed at upsetting bacterial metabolism; but since virus metabolism was essentially the metabolism of the cells of the host which carried the virus, it was not reasonable to expect a chemotherapeutic attack on viruses along similar lines. Moreover, the necessity to provide living cells as culture media for viruses usually demanded inoculation of living animals as the means of propagating these microorganisms. Further, the type of tissue and the animal chosen must fulfil the exacting needs of the virus. So it was that most strains of poliomyelitis virus would grow only in man or in monkeys of certain types. It was possible to observe a discontinuous mutation of viruses, whereby the microorganisms became adapted to grow under different conditions. Thus one or two adapted strains of poliomyelitis virus could grow in mouse brain. Mutation in another direction was presumably one factor governing the incidence of epidemics of paralytic poliomyelitis in man.

Dr. Anderson went on to say that as a parallel to the study of the epidemiology of the human disease, a similar disease of mice had been observed. In 1937 Theiler (*The Journal of Experimental Medicine*, Volume LXV, 1937, page 705) described a paralytic disease which attacked an occasional mouse among the laboratory stock, and three years later Olitsky (*The Journal of Experimental Medicine*, Volume LXXII, 1940, page 113) discussed the epidemiology of this condition. It appeared that nearly every mouse was infected by fæcal contamination with the virus which inhabited the gastro-intestinal tract sometimes only in the first few weeks, sometimes for the duration of the life of the animal. No symptoms were produced. However, in an occasional animal the virus assumed a neurotrophic, pathogenic form, and that animal became paralysed and died. It was interesting to consider in the light of these findings that the habitat of the causal agent of human poliomyelitis had been strongly suggested to be the gastro-intestinal tract.

Clinical Features of the Present Epidemic.

DR. H. MCLORINAN said that, although it was not comparable to the great epidemic of 1937, the present increased incidence of the disease was sufficient to cause anxiety. At that stage it was impossible to predict the course of the epidemic during the coming summer months. After the epidemic in Sydney a few cases had been reported in Victoria in the late summer of 1945. It was not until July, 1945, however, that there had been any noticeable increase in Melbourne. Since then cases had been occurring simultaneously in the city and the country. In October and in the early days of November it appeared as if the epidemic was likely to die out; but there had been an increase during the last few weeks. Approximately eighty patients with the disease had been admitted to the Queen's Memorial Infectious Diseases Hospital, Fairfield, since July, and over 140 cases had been reported in Victoria.

With regard to the epidemiology, Dr. McLorinan said that it had to be frankly admitted that the situation remained "confused". Considerable publicity had been given to the finding of living virus in fæces of patients and contacts, in sewage and in flies. This had led to considerable speculation, and indeed emphatic statements had been made that the main source of infection was infected food and fluid for drinking. While not attempting to belittle the importance of this work, Dr. McLorinan said that he was sure that it would be difficult to convince any of those who saw the 1937 epidemic in Melbourne that excremental spread played any significant part. The 1937 epidemic and also the present outbreak were unusual, in that they both began in the depths of winter—a season when it was difficult to find any flies or other possible insect vectors in Melbourne. The present outbreak differed in many respects from the 1937 epidemic. First, there had been no obvious geographical spread; cases had occurred simultaneously in widely scattered districts in the city and country. Secondly, there

had been little or no evidence of case-to-case spread. In only three instances had there been more than one case in a family. The infections were generally milder than in 1937. Among eighty patients admitted to the Fairfield Hospital there had occurred only one death. Another patient died in the ambulance on the way to hospital, and the diagnosis was subsequently made *post mortem*. Bulbar paralysis had been comparatively rare. A surprisingly high proportion of adults had been affected. Thirty-one patients were aged over fourteen years; among these the disease had been noticeably more severe. Five patients had been treated in respirators, and four of these were adults.

Dr. McLorinan said that despite the risk of being considered too elementary, he would describe what he considered the typical course of a case of poliomyelitis during the first seven to ten days of illness. This period might be referred to as the febrile period, and it might be divided into three stages: (i) the stage of malaise; (ii) the meningeal stage; (iii) the stage of development of paralysis. These stages were not always distinct, and each stage might be shortened or lengthened in different cases. The first, the stage of malaise, lasted for one to three days. The symptoms were those of any febrile illness—fever, vomiting, headache and irritability—and they had obvious limitations as aids to diagnosis. Lumbar puncture at this early stage was unlikely to reveal any characteristic changes in the cerebro-spinal fluid. It was possible to perform a lumbar puncture too early and produce a stiff back, which might be misleading later on. During this early stage of malaise it was almost impossible to diagnose the disease. The second stage was referred to as the meningeal stage. In the strict pathological sense the name was wrong. There was no true invasion of the meninges. This stage also lasted for one to three days. Fever persisted, and the patient was as a rule lucid and cooperative. The typical neck stiffness and "spine signs" should now dominate the clinical picture. They were the mainstay of the diagnosis, and were rarely completely absent. Various spine tests, such as Amoss's sign, were of great value. Neck stiffness was not so pronounced as in meningitis, and it might be slight; but flexion of the neck and back always produced some pain. Pain in the limbs and hyperæsthesia were given prominence in textbooks as important symptoms. Dr. McLorinan said that in his opinion, the importance of muscle pain as an aid to diagnosis had been much exaggerated. It was frequently absent and was rarely severe. It was much commoner in the paralytic stage, when it might be distressing. Tremor, apprehension and dilated pupils might also be present in the meningeal stage. They had not been so noticeable in the present epidemic as in 1937. Retention of urine had occurred only in severe cases, and was more common in adults. The cerebro-spinal fluid changes, which usually occurred at this stage, had been typical. Absence of cells was always a strong argument against poliomyelitis. The average cell count had been lower than in 1937. It was always found that a high cell count (300 and upwards) was an indication of severity. The cells had been predominantly lymphocytes, but 50% of polymorphonuclear cells had been common. Protein estimations had been of little value as an aid to diagnosis; but the chloride content had been estimated in every case to avoid possible confusion with tuberculous meningitis. The third stage—the stage of development of paralysis—usually lasted three or four days, but might be extended to a week; by that time the temperature had become normal and no further paralysis developed. The diagnosis should now be relatively easy; but it was surprising how difficult it might be, in the case of a non-cooperative child, to distinguish between pain in a limb from other causes and genuine muscle weakness. At the commencement of the paralytic stage different clinical pictures might arise, according to the region of involvement of the spinal cord and brain. Thus there were the spinal type, the cranial or bulbar type, and the combination of the two, the bulbo-spinal type. Facial paralysis, palatal and pharyngeal paralysis and respiratory weakness indicated the development of the bulbar type. The onset was often rapid and dramatic, and the meningeal stage was often short or absent. After a brief period of malaise the signs of medullary failure might develop rapidly. Respirator treatment was of little avail in these cases. Fortunately, this type of case had been uncommon, and so far in the present epidemic most patients had developed the typical "spotty" paralysis of the spinal type. As usual there had been no rule or order in the development of weakness. There had been three examples of the ascending or Landry's type of paralysis. All the patients had been adults; one had died in a respirator, and the other two were hopelessly paralysed. There had been several examples of the "abortive" type; by this was meant that the patient had the typical malaise and meningeal signs, but developed no muscle weakness. The diagnosis should not be made until the patient was examined carefully out of bed or was allowed to walk about for a few days. A competent physical therapist would often detect a slight weakness or increased fatigability of a muscle some weeks later. Pain had been rather a common feature in the paralysed muscles, more so than in 1937. These patients asked for change of position, and were temporarily relieved by it. It would appear that this was a strong argument against early splinting.

With regard to diagnosis, Dr. McLorinan said that, as was only natural during an epidemic, many patients had been sent to Fairfield in whose case the diagnosis of poliomyelitis had not been confirmed. Very few "missed" cases had occurred. Dr. McLorinan said that he presumed, however, that the orthopædists would be seeing during the next few months many patients with muscle weaknesses and possibly deformities which had been a sequel to undiagnosed poliomyelitis. Common mistakes in diagnosis had been upper respiratory tract infections with backache and muscle pains, early pneumonia with meningismus, acute rheumatism, meningitis and encephalitis. An interesting patient was a child suffering from whooping cough and hemiplegia. Another child from the country was in hospital with a generalized symmetrical weakness of all four limbs and no neck stiffness; there were no cells in the cerebro-spinal fluid, but the protein content was slightly raised. It would take a brave man to say that she was not suffering from poliomyelitis; but it was hoped that she would prove to be suffering from acute infective polyneuritis with the consequent more favourable prognosis. Dr. McLorinan said that for help in diagnosis, he would refer any one to the excellent pamphlet drawn up in 1937 by Dr. M. Powell and Dr. S. Williams and circulated to practitioners. He quoted from one paragraph:

> It has been the experience of observers in this epidemic that when poliomyelitis is present, it is present alone. The presence of any unusual signs, e.g., earache, cough, rapid respiration, excessive diarrhœa, make one very guarded; also in the absence of the spine signs, pains in the limbs is unlikely to be poliomyelitis.

With regard to treatment, Dr. McLorinan went on to say that no specific form of treatment had been developed. No way was known to stop the development of paralysis. "Prostigmin" had been given in the more severe cases, but without any noticeable effect. Dr. McLorinan said that he would leave the treatment of the affected muscles for discussion by the orthopædists. With regard to isolation and nursing, three weeks' quarantine appeared to be ample, in spite of the fact that the virus had been obtained in the fæces of a few patients for weeks and months after an attack. So far as was known, there was no record of any person's becoming infected from a poliomyelitis patient after the first week. The nurses were advised to take precautions similar to those in the nursing of typhoid fever patients. Careful attention was paid to bed pans, soiled linen *et cetera*, and nurses were not permitted to eat in the wards.

With regard to prevention, Dr. McLorinan said that the evidence was strong that poliomyelitis occurred more often among children who had recently undergone tonsillectomy than among others, and if it developed it was more likely to be the dangerous bulbar type. Dr. Scholes had quoted an experience at Fairfield in 1937. A child convalescent from scarlet fever underwent tonsillectomy, and the same day a new patient was admitted to the next bed who was suffering from typical scarlet fever, but later developed some unusual signs which were probably caused by abortive poliomyelitis. Ten days later the child who had undergone tonsillectomy developed bulbar poliomyelitis. There was also the well-known instance of the family of six children, five of whom were subjected to tonsillectomy; all five developed poliomyelitis, and three died from the bulbar type. The sixth child, who had not been subjected to tonsillectomy, did not develop poliomyelitis, but virus was recovered from the fæces. A recent issue of the *Journal of Pediatrics* contained an interesting account of a survey carried out during an epidemic in Salt Lake City. The operation of tonsillectomy was not restricted during the early part of the outbreak. The following findings were recorded:

> The incidence of poliomyelitis in recently tonsillectomized children (within thirty days) was found to be two to six times greater than in the general child population. The incidence of the bulbar and bulbo-spinal type of poliomyelitis was found to be sixteen times greater in recently tonsillectomized children than in the general child population.

Finally an American dental journal published some significant figures showing that the incidence of poliomyelitis was higher in children with exposed dental pulp than amongst children with sound teeth. At the time of the meeting Melbourne dentists were making a survey of all patients in the present epidemic. It appeared that evidence was accumulating that any open wound in the upper respiratory tract during an epidemic of poliomyelitis was a potential source of danger.

Early Detection of Mild Paralysis.

DR. JEAN MACNAMARA said that Dr. McLorinan had pointed out that many patients affected in the present epidemic had not been severely paralysed. She thought, therefore, that it might be of interest to show some of these patients with mild paralysis and to indicate the methods adopted to determine the extent of involvement. There were no orthopædic patients who justified such care and trouble as patients affected by poliomyelitis when the lesions were scattered and not localized and intense. Dr. Webster's slides had demonstrated that frequently a number of cells survived in any area of the affected spinal cord. In the present epidemic, among many of the children so far affected, the percentage of survivors must have been high, for the natural tendency to complete recovery of power had been pronounced—provided that the muscles innervated by those nerve cells which had escaped were given the opportunity to recover by protection from fatigue and from deformity.

The first patient shown was a boy, aged eight years, who had been admitted to the Fairfield hospital with involvement of his palate and laryngeal muscles. One month later he was referred to the Children's Hospital for after-care, greatly improved, but still showing the pallor and lassitude which had characterized children with palate paralysis in the present epidemic. A muscle examination revealed weakness of the right shoulder abductor muscles, while the right arm was held in internal rotation. His posture was poor. The weakness was hardly severe enough to warrant splinting, so during the past months he had been given two weeks of complete rest in bed and two weeks of rest with exercises carried out twice a day to improve his posture and to increase the power in the arm. Arrangements had been made for swimming lessons. Dr. Macnamara said that she had chosen this patient to demonstrate simple tests for relative loss of power in the lower limbs. When seated on a chair adapted to his size he was asked to fold the arms, raise one foot from the ground and stand up, using the other lower limb entirely to elevate the body from the sitting position to the erect. This test quickly revealed any relative difference in power between the hip extensors and the quadriceps muscles of one side as compared with the other. He was asked to stand, raise one foot from the ground and stand on tip toe on the other foot alone. This was a hard test for the calf muscles. He was asked to walk on his heels in order to demonstrate any difference in the power of the dorsiflexors of the feet when acting against gravity. He was asked to stand on one leg and then on the other to demonstrate any lateral sway of the trunk which occurred when the abductor muscles of one hip were involved.

The second patient shown by Dr. Macnamara, a girl, aged three years, was shown to demonstrate the wasting which had been a feature in the epidemic, especially its rapid development and its degree. The latter did not parallel the loss of power in the affected muscle. In this instance, after an illness the mother had noticed that the child limped when tired, but she did not worry until the wasting had become obvious. Dr. Macnamara said that in such cases it was well to give a guarded prognosis about the subsequent growth of the limb as compared with the normal limb, especially if any difference in temperature was obvious. From past epidemics patients had come for cork compensation for shortening of limbs in which the residual loss of power had been negligible.

The third patient, a girl, aged eleven years, was shown to demonstrate weakness of the right arm and right scapular muscles, especially the rhomboids and serratus, associated with antecedent poor posture. It was thought that if she was provided with the usual type of deltoid splint for ambulant patients, her shoulder muscles would recover but she would develop scoliosis, and that it would be safer to apply splints in recumbency with the arm abducted for some weeks and to teach her while resting how to use her abdominal and buttock muscles to control her posture when erect. This had not been fully achieved, but she was allowed some walking liberty, the splint being used to ration that activity.

Dr. Macnamara's fourth patient was shown to demonstrate fascial paralysis and involvement of the sterno-cleido-mastoid muscles, for he could not flex his head on the neck against gravity unless he helped by pulling his head up by a tug with his hand on a lock of hair. When neck stiffness persisted, it sometimes appeared that the neck flexors were weak when they did not act because of the pain involved by their action.

Dr. Macnamara said that in the present epidemic there had been the same tendency for stiffness to persist for several weeks, irrespective of splinting, which was observed in the epidemic of 1937-1938. She showed pictures to demonstrate the vulcanite splint made for use in facial paralysis as designed by the late Dr. Kenneth Russell; splints to take care of the most valuable intrinsic muscles of the hands, diagrams to illustrate how, so far as economic usefulness was concerned, in the upper limb the muscles furthest from the trunk mattered most and in the lower limbs those nearest the trunk were of greatest value. It was stressed that in the present epidemic there was danger that early weight-bearing on affected lower limbs would be responsible for more real crippling than the actual damage done by the virus of poliomyelitis. The patients with milder paralysis, with their possibility of complete recovery, demanded care that no deformities should be allowed to develop, and that no muscle striving to recover should be flogged into greater weakness by fatigue.

Discussion.

DR. GUY SPRINGTHORPE asked for clarification of two points. First, he wondered whether the spine sign might persist for more than three or four days. In this respect he recalled a family of three who came under his notice. The youngest child, aged two years, suffered a febrile illness without sequelæ and recognized in retrospect as "abortive" poliomyelitis. A second child, aged thirteen years, contracted a febrile illness followed by paralysis in one limb. The third member of the family, aged seventeen years, also had a febrile illness, after which he developed palatal paralysis. Both the older children had persistence of the spine sign beyond the usual three or four days. Dr. Springthorpe said that his second question arose as a result of references in American literature to spread of the disease by fæcal contaminants. These authorities had recommended discontinuance of swimming in fresh water baths, and he wondered whether there was a real danger of spread in this fashion.

DR. ROBERT SOUTHBY said that he had little to add. From the clinical viewpoint, it was realized that after a spell of seven or eight years the medical profession might be caught unawares, especially by the first few cases. He was interested to hear Dr. McLorinan say that it was impossible to dogmatize on the length of the period of malaise. However, the doctor in practice was expected to pronounce on this. If with evidence of meningismus it was possible to demonstrate an inflamed ear drum or pyobacilluria or any definite entity, the chances were that the meningismus was an accompaniment of one of these diseases. However, if meningismus occurred alone, it was wise to perform a lumbar puncture and to observe the number of cells in the cerebro-spinal fluid. Dr. Southby went on to say that as poliomyelitis was an infection involving the nervous system, convulsions would be expected to occur, at any rate in some cases. However, if convulsions occurred, it was usual to be able to find evidence of some other disease than poliomyelitis. Dr. Southby said that if the opportunity presented itself in a suspected case of examining the child whilst he was asleep, this should be done; it was often possible to demonstrate differences between the two limbs. In a few odd cases this might prove helpful. Dr. Southby had little to offer in regard to prevention. He said that Dr. Scholes would remember how in the last epidemic it was thought wise to close theatres and schools to children. This had repercussions in his own suburb. On arriving home from a meeting, Dr. Southby said that he had found about sixteen children gathered in his car shed, squirting themselves with water from the tap. There was no doubt that the public had peculiar ideas on isolation. He had seen university graduates keep their children from school, but take them along to the Victorian market.

DR. WILFRED FORSTER said that he had tried to find cases occurring in which an upper motor neurone lesion led to rigidity and extensor responses to the plantar reflexes. He had never been able to satisfy himself that this had occurred as a sequel to poliomyelitis, though he had often seen spastic children who had given a vague history of some preceding infection. Dr. Forster asked Dr. McLorinan whether he had encountered an indubitable case of this nature.

DR. RUSSELL HOWARD said that he was interested in the increased incidence of poliomyelitis after tonsillectomy. He

asked whether it was thought that poliomyelitis occurred after tonsillectomy by infection with virus already present in the naso-pharynx, and what was the practice in regard to emergency operations of this nature.

DR. H. DOUGLAS STEPHENS protested against blind following of the prohibition against tonsillectomy and other operations on the mouth and throat. If this was rigidly observed, children with hare-lip and cleft palate would be denied the opportunity of getting the optimum results from their operation. Dr. Stephens said that he thought that sometimes undue stress was laid on mild paralysis of perhaps a single muscle, the child being kept in recumbency for long periods of time. It was better to allow such a child to get about, otherwise he became a potential applicant for the invalid pension.

DR. ERIC PRICE said that with regard to pathology, attention had always been focused on the central nervous system. Changes which were presumably secondary occurred elsewhere, especially in muscles. Two points had arisen since the 1937 epidemic. The first was the occurrence of apparent spasm in a certain type of patient. In such types the antagonists to the involved muscles were engaged in trying to pull the limb out of position. The second point was the pathological condition of certain muscles which had become "stiff". Full range of movement was lost in such cases, and this appeared to be due to muscle inelasticity. Dr. Price said that he had fractured two femora trying to make the knees move in two such cases. In conclusion, Dr. Price asked, in view of the fact that the virus was intracellular, how it was cultivated and identified in series.

Dr. Webster, in reply, with regard to fresh water baths, said that since it had been shown that the virus was excreted in fæces and might be present in saliva, it was only reasonable to bar communal bathing. With regard to cerebral cortical lesions, Dr. Webster said that in the past it had been taught that lesions were met with no higher than the mid-brain; but more recently changes had been described as high as the motor cortex. It did not necessarily follow that the upper motor neurone type of lesion would be encountered. This finding might be only an academic point, which nevertheless must be accepted. In answer to Dr. Howard, Dr. Webster said that the attack was made by virus already present in the pharynx. The oro-pharynx was a more likely site of entry than the naso-pharynx. Dr. Webster went on to say that many points remained unsettled. It was well established that the virus was often present in sewage, but no one knew how it travelled from sewage to humans. To make things more difficult, it had been shown that the virus might reach the body through the skin, and this introduced the possibility of a biting insect as vector; the disease actually had been transmitted by subcutaneous inoculation. An interesting observation in 1941 was the coincidence in Canada of an epidemic of equine encephalitis with an epidemic of poliomyelitis. Furthermore, these diseases had waxed and waned together. Equine encephalitis was known to be mosquito-borne, but no evidence implicating the mosquito in poliomyelitis had been obtained. With regard to pathological changes in the muscle, Dr. Webster said that at the height of the disease there were no pathological changes in the peripheral nerves or muscles, and the changes which supervened were those that resulted from atrophy of disuse of denervated fibres.

Dr. Anderson, in reply, said that material for culture could be inoculated into animals by various ways. Originally this was done intracerebrally, and now it was possible subcutaneously and orally. The virus multiplied only in cells; but if no living cell was present the virus maintained its capacity for function and could remain potent for long periods at low temperatures.

Dr. McLorinan, in reply, said that he had seen the spine sign persist for a month after an attack. Neck stiffness did not persist in such fashion and usually disappeared after two or three days. With regard to the danger of swimming baths, it had still to be proved that the virus in fæces could infect children. Convulsions in the early stage of poliomyelitis were a rare sign, but their presence did not preclude that disease. In reply to Dr. Forster's question about the occurrence of spasm, Dr. McLorinan said that he could recall a case during the 1937 epidemic and possibly another. In an epidemic of poliomyelitis at Los Angeles in 1936 or 1937 a large number of adults were stricken, including doctors, nurses and students. This outbreak was extraordinary, since in the majority of cases spasticity of muscles occurred. Grave doubts were held by others in America that these were cases of poliomyelitis; but the investigators isolated the virus and transmitted it to monkeys. In reply to Dr. Howard, Dr. McLorinan said that the virus was in the throat at the time of the tonsillectomy. It was quite likely, however, in the case he had quoted which occurred at the Fairfield hospital, that the child who suffered the "abortive" illness transmitted the disease to the child whose tonsils had been enucleated.

Dr. Macnamara, in reply to Dr. Stephens, said that she had not been able to discover a way of rationing the activity of children except to keep them in splints. She had observed in an epidemic at Camperdown in 1934 that animals were also affected. Adults proponderated over children, and the affected people lived in widely scattered districts. All, however, were great milk consumers. Cats and pigs developed paralysis in the epidemic. The paralysis could be transmitted to animals by intracerebral inoculation. Many years earlier, Jenner had shown that man's association with animals was a potent source of disease to him. Dr. Macnamara went on to say that the present outbreak was the eighth ordinary epidemic of poliomyelitis in Victoria. In most of these it was not possible to discover a link between cases; but in the 1937 epidemic it was obvious that spread had occurred from one person to another. Dr. Macnamara said that she never could see how spread by the olfactory nerve explained human poliomyelitis. In 1937, one could not help wondering whether the disease might not be similar to swine influenza of Iowa. It appeared that when the two organisms acted together, the disease occurred in its most virulent form; but when the virus acted alone, the disease took the form of an innocuous febrile ailment. Finally, Dr. Macnamara said that now that the alimentary approach was becoming more popular, it might be possible to follow an interesting line of inquiry that had previously exercised her mind. It was known that the virus was killed by the acidity of the normal adult's stomach. The pH of children was usually low, and she wondered whether the patients attacked were those with exceptionally low gastric acidity.

Correspondence.

RESEARCH AT THE KANEMATSU INSTITUTE.

SIR: I desire to direct your attention to the recent action of the board of directors of Sydney Hospital in ordering the abrupt cessation of all research work in the Kanematsu Institute by April 1, and in dismissing, with only a few weeks' notice, the research workers and technical staff. Such an unprecedented action will have repercussions extending far beyond their local domain, not only to Australia, but to the scientific world.

In Australia there is raised often enough the wail that her best scientists leave her to work in other countries. Have not we here in this action of an important public board a particularly clear demonstration of a situation which drives scientists away and deters others from coming? In fact the board would seem deliberately to have challenged an investigation into the way in which Australia has built up its unenviable reputation in regard to scientists; hence an exposure of their methods might well lead to an understanding of the malady and its effective treatment.

I propose therefore to give a brief account of the circumstances that eventually made me realize that my position as director had become untenable, and in April, 1943, I wrote to England to that effect. The offer of a chair of physiology there followed some months later, but I accepted my present Otago appointment instead. I give these details in order to make it clear that I was not attracted away from the Kanematsu Institute by the offer of a better position.

The difficulties besetting a director of the Kanematsu Institute derive largely from the retention of complete executive power by the board of directors of Sydney Hospital. The advisory committee of the institute is appointed by the board and is largely composed of medical men and scientists, but it can merely make recommendations in writing to the board. Likewise the director has no executive power whatsoever, and communications to and from the board are in writing. Though director for six and a half years, I only appeared before the board on the occasion of my presentation to it on arrival. Such an arrangement operated tolerably well for the first two years of my directorship, but thereafter the executive actions of the board became more peremptory and irritating. It was increasingly evident that I was director in name only. Rather than enumerate sordid details, let one instance suffice as illustration. Early in 1943 I heard from the technical staff that the board contemplated adding on top of the Kanematsu Institute two floors for residents' quarters. That would have meant demolishing the research laboratories on the roof and blocking all future expansion of the institute. Plans

were drawn and the Minister of Health brought to the site, and yet the board had not thought it necessary even to advise me of the matter. I refused to believe that such discourtesy was possible until I had confirmed it by private inquiry from a member of the board. The contempt of the board for the director was only too evident—my position had become untenable. On my departure for New Zealand some months later there was no word of thanks from the board, no valedictory message, no appreciation of any kind. In fact it is worthy of note that throughout my six and a half years' appointment my efforts received no encouragement of any kind except from Mr. John Travers, who was president for a short time after my arrival. And yet during that period and subsequently to my departure the research work of the institute gave it an international reputation, in evidence of which I will cite the recent appointments of Dr. Katz to the assistant directorship of a new institute at University College, London, of Dr. Kuffler to a special research position at the University of Chicago and my recent invitation to America to address the first international gathering of physiologists since the war. Moreover, the institute had a creditable war record. In it was set up a plant which processed about 75% of Australia's serum production, and its workers have pioneered the Australian investigation of acoustic war problems, taken a share in solving the visual and lighting problems of warfare, contributed to the treatment of muscle disabilities and performed fundamental work on the clotting of blood.

All of this achievement in research and investigation was described in annual reports which were distributed to all members of the board. One could only assume their complete indifference to the research activity of an institute, which, nevertheless, they insisted on controlling despotically. Subsequent events have apparently revealed that this indifference has given place to the hostility made evident in their most recent act.

The question arises: How did this research institute come to disaster at Sydney Hospital, whereas the Hall Institute of Melbourne Hospital flourishes so magnificently? It may be inappropriate for me to suggest that it lies in the board of directors of Sydney Hospital rather than in the directors of the institute, but at least it may be stated that the same board has caused in succession both of the directors to resign. Moreover, in Melbourne the Hall Institute is controlled not by a hospital board, but by a specially appointed board which includes the director. Had such a control been instituted at Sydney Hospital, the present disaster undoubtedly would have been averted.

In conclusion, I would offer the following suggestions in regard to the control of research and of research institutes:

1. That public money for research institutes should be granted only to those controlled by boards whose members are specially chosen for their interest in and understanding of research (as occurs at the Hall Institute in contradistinction to the Kanematsu Institute).
2. That, when a director of a research institute is appointed, he be given the fullest possible freedom of action (as occurs at the Hall Institute in contradistinction to the Kanematsu Institute).
3. That, when a research institute comes to disaster (as has occurred at the Kanematsu Institute), the fullest inquiry be made in order to determine the circumstances, so that such disasters may be avoided in the future.

In such an inquiry it would be pertinent to ask the board of directors of Sydney Hospital the following initial questions:

1. Will the board make a public statement attempting to justify their action in closing down all research activity in the Kanematsu Institute and giving a few weeks' notice to research and technical staff?

2. There is approximately £17,000 credit to the research funds of the institute derived as follows: gift from Lord Nuffield, £4,000; gift from State Government, £4,000; accumulated balance from annual State Government grant, £9,000. Can the board state how this money is to be utilized, and can they justify such an abrupt and complete abolition of research activity when they hold this money for research, only £8,000 of which must be retained as capital?

3. The board has recently accepted from the National Health and Medical Research Council the gift of the workshop equipment of the Kanematsu Institute valued at about £500. Precisely at that time they were shutting down all medical research there. Was the workshop transaction completed without informing the Medical Research Council that it had been decreed that all research was forthwith to cease?

No doubt the board's answers will prompt other questions, particularly in relationship to their methods of controlling the Kanematsu Institute. Such an inquiry should be of great interest and value not only to all boards and directors controlling research institutes, but also to research workers and to those interested in establishing new research institutes on sound lines. I therefore hope that the inquiry be as full and searching as possible.

Yours, etc.,

J. C. ECCLES,
Professor of Physiology.

University of Otago,
Dunedin,
New Zealand.
April 11, 1946.

SIR: Lest it be thought that in resigning from the staff of the Kanematsu Institute on April 1 as a protest against the suspension of research at that institute, I had overlooked certain ethical principles in relation to my responsibilities as a medical practitioner, I would ask you to publish the two appended letters.

One letter was handed by me to the secretary of Sydney Hospital on the morning of April 1; the other, an official acknowledgement from the acting secretary of the hospital, reached me on April 18.

On April 1 I also handed to the superintendent of Sydney Hospital a letter similar to that given to the secretary. This letter has been acknowledged today.

Yours, etc.,

A. J. CANNY.

16, David Street,
Clifton Gardens,
New South Wales.
April 20, 1946.

[COPY.]

16 David Street,
Clifton Gardens,
1st April, 1946.

The Secretary,
Sydney Hospital.
Dear Colonel Burrett,

As I informed you verbally when tendering my letter rejecting the Board's offer of the Directorship of the Kanematsu Institute, I do not wish the resignation which has been forced upon me to prejudice in any way the care or welfare of the patients of the Hospital.

I will be ready from today when I relinquish active duties on the Hospital staff to help in any way, without remuneration, with whatever pathology is essential for the care of the sick until some other arrangements adequate to meet these essential needs can be made, provided I am requested to do so in writing by the Superintendent or yourself on behalf of the Board of Directors.

Yours faithfully,
(Signed) A. J. CANNY.

[COPY.]

Sydney Hospital,
17th April, 1946.

Dr. A. J. Canny,
16 David Street,
Clifton Gardens.
Dear Dr. Canny,

I am directed to inform you that your letter of the 1st April, wherein you offered to help with any pathology necessary, was placed before the house committee, and I have to advise you that your letter was received.

Yours faithfully,
E. C. DOCKING,
Acting Secretary.

SIR: When three weeks ago it became obvious to me that my position at Sydney Hospital as assistant pathologist no longer was tenable, I submitted my resignation, but in order that my precipitate exitus should not prove detrimental to the interests of the patients, I had delivered to the Secretary on April 6 the following letter:

6th April.

Dear Sir,

In my resignation recently tendered to you in person, I informed you of my decision to leave the hospital staff as from the 8th April, 1946.

As I do not wish this hasty departure to prejudice the welfare of the sick patients, I wish to inform you that, if requested to do so in writing, I am quite prepared to undertake (in an unpaid capacity) any of the essential pathological work of the department during such a time as the hospital might reasonably need for the organization of an efficient temporary essential service.

This offer, of course, is conditional on the request emanating from either the Secretary or the Medical Superintendent.

Yours faithfully,

T. H. VICKERS.

On April 9 I was notified of the house committee's decision to accept my resignation. On April 16 a letter was posted to the Secretary pressing him for a statement on the resolutions of the house committee regarding the offer of my services in an honorary capacity as from April 8, and on April 18 I received the following note from the Acting Secretary:

17th April.

Dear Sir,

I am directed to inform you that your letter of the 6th April, wherein you offered to help with any pathology necessary, was placed before the house committee, and I have to advise you that your letter was received.

Yours faithfully,

E. C. DOCKING,
Acting Secretary.

If you are able to publish this letter in full, sir, you will be giving me the opportunity of answering those who have sought to attack my ethical standards by alleging that I walked out of Sydney Hospital indifferent of my professional responsibilities to the patients.

Yours, etc.,

T. H. VICKERS.

21, Bellevue Street,
Manly,
New South Wales.
April 24, 1946.

Post-Graduate Work.

MELBOURNE PERMANENT POST-GRADUATE COMMITTEE'S PROGRAMME FOR JUNE.

THE Melbourne Permanent Post-Graduate Committee has arranged the following programme for June, 1946:

Intensive Refresher Courses.

A course designed for general practitioners will be conducted from June 3 to June 15. The fee is ten guineas. This course is full time and details of demonstrations will be published later.

Continuous Refresher Course.

The third series of refresher classes for service and ex-service medical officers will commence on June 3. They will be conducted on four days of each week at the Royal Melbourne, Alfred, Saint Vincent's and Children's Hospitals, and will continue for two months.

Course Suitable for Candidates for the M.D. Part II and M.R.A.C.P. Examinations.

The series of clinical lecture-demonstrations designed for candidates who intend to sit for the M.D. Part II and M.R.A.C.P. examinations will be continued on Tuesday afternoons from 2.15 o'clock p.m.

June 4, by Dr. W. J. Newing on "Chronic Non-Tuberculous Pulmonary Disease".
June 11, by Dr. R. P. McMeekin on "Optic Nerve in Relation to Neurological Diagnosis".
June 18, by Dr. E. Downie on "Diabetes".
June 25, by Dr. F. Niall on "Chronic Arthritis".

University Classes.

University classes for Part I of the higher degrees and diplomas, including the diploma of anæsthesia, will be continued.

Course at Geelong.

The third demonstration of the course at the Geelong Hospital will be given at 8.30 p.m. on Wednesday, June 19, by Dr. B. L. Stanton on "Recent Advances in Therapeutics". Those wishing to attend should communicate with Dr. Alan Kidd, 216, High Street, Belmont, Geelong.

Course at Flinders.

On Wednesday, June 5, Dr. L. Hurley will conduct a demonstration on "Medical Emergencies" at the Flinders Depot. This will be part of a course arranged for naval medical officers.

Enrolment for Courses.

Enrolments for courses in Melbourne should be made two weeks before commencement with the Secretary, Post-Graduate Committee, College of Surgeons, Spring Street, C.I. Telephone: JM 1547-8 (new number).

POST-GRADUATE WEEK IN BRISBANE.

THE Post-Graduate Medical Education Committee of the University of Queensland announces that a full-time refresher course has been arranged for post-graduate week from Saturday, June 1, to Friday, June 7, inclusive.

An excellent programme has been arranged. Three eminent clinicians from other States have been invited to take part in the proceedings of the week. Dr. Homes à Court will deliver the Bancroft Memorial Lecture on Friday, June 7. Dr. C. H. Fitts and Mr. C. J. Officer Brown, recently returned from overseas, will give, as well as other lectures, a symposium on the treatment of pulmonary tuberculosis from its medical and surgical aspects. The fee for the week's course is £2 2s. It is included as part of the general revision course for predischarged service medical officers. Country and metropolitan practitioners who, owing to the pressure of work during the war, have been unable to keep their reading of medical literature up to date, are urged to attend.

As it is anticipated that such a concentrated series of lectures and demonstrations will have a wide appeal to doctors throughout the State, and, as it will be necessary to limit the numbers at some of the sessions, members are asked to enrol as soon as possible by writing to Dr. P. H. Macindoe, Honorary Secretary, The Medical School, Herston Road, Fortitude Valley, Brisbane.

The full programme will be published later.

Naval, Military and Air Force.

APPOINTMENTS.

THE undermentioned appointments, changes *et cetera* have been promulgated in the *Commonwealth of Australia Gazette*, Number 53, of March 21, 1946.

AUSTRALIAN MILITARY FORCES.

Reserve of Officers.

Australian Army Medical Corps.

The undermentioned officers are transferred to the Reserve of Officers, with effect from the dates shown and, where applicable, cease to be seconded on the date prior to such transfer. Officers holding temporary rank relinquish such temporary rank on the date of transfer to the Reserve of Officers.

Captains NX35147 P. I. A. Hendry and NX35102 A. K. Barrett, 4th November, 1945, and WX11168 Major B. W. Nairn, 11th November, 1945.

Captains QX53967 H. J. L. G. Oxley, 13th November, 1945, and QX31468 J. S. Sullivan, 7th November, 1945, SX38772 Captain (Temporary Major) C. M. Deland, 20th December, 1945, and VX102681 Major K. Brennan, 10th November, 1945.

No. 105 (Adelaide) Military Hospital.—SX1478 Major C. Gurner, 13th December, 1945.

107th Australian General Hospital.—QX6268 Major G. C. H. Hogg, 8th November, 1945.

No. 115 (Heidelberg) Military Hospital.—SX12939 Major F. R. Magarey, 14th December, 1945.

Inter-Service Medical Wing Demobilization Centre, Australian Military Forces Component.—QX36745 Major K. S. Crouch, 3rd November, 1945.

Majors VX45273 J. J. Searby, 10th November, 1945; VX61356 H. H. Eddey, 9th November, 1945; SX10761 A. F. Hobbs, 28th November, 1945; VX45320 K. B. Burnside, 15th November, 1945; and VX60748 R. G. Orr, 14th November, 1945; Captains VX39183 P. N. O'Donnell, 14th November, 1945; and SX14044 C. P. Juttner, 24th November, 1945.

SX11165 Captain (Temporary Major) R. K. Wilson, 1st December, 1945.

102nd Australian General Hospital.—QX44606 Major T. K. Wilson, 23rd November, 1945.

67th Australian Camp Hospital.—QX45113 Captain S. J. Rumbold, 9th November, 1945.

1st Australian Out-Patients' Depot.—N393325 Captain F. E. Barclay, 3rd November, 1945.

ROYAL AUSTRALIAN AIR FORCE.

Citizen Air Force: Medical Branch.

The following Temporary Squadron Leaders are granted the acting rank of Wing Commander whilst occupying Wing Commander posts with effect from the 11th December, 1945: C. V. W. Brown (271467), A. E. Dickmann (252396).

The following Flight Lieutenants are granted the acting rank of Squadron Leader whilst occupying Squadron Leader posts with effect from the 11th December, 1945: D. W. Short (283944), D. F. Buckle (263865), E. Dennis (296288), O. K. Kewish (256693), E. F. Northcroft (266734), N. F. Pescott (255177).—(Ex. Min. No. 64—Approved 20th March, 1946.)

Reserve: Medical Branch.

Temporary Wing Commander R. I. Greenham (291188) is transferred from the Active List with effect from 16th November, 1945.—(Ex. Min. No. 65—Approved 20th March, 1946.)

The following officers are transferred from the Active List with effect from the dates indicated: (Temporary Squadron Leaders) H. C. Taylor (264368), 11th October, 1945, A. McGlynn (262722), 19th October, 1945.—(Ex. Min. No. 66—Approved 6th March, 1946.)

Temporary Flight Lieutenant M. P. A. Kirton (257524) is transferred from the Active List with effect from 9th October, 1945.—(Ex. Min. No. 70—Approved 20th March, 1946.)

Australian Medical Board Proceedings.

NEW SOUTH WALES.

THE undermentioned have been registered, pursuant to the provisions of the *Medical Practitioners Act*, 1938-1939, of New South Wales, as duly qualified medical practitioners:

Jacobs, Lionel Allenby, M.B., Ch.B., 1942 (New Zealand), Marnie Flats, Kirribilli Avenue, Milson's Point.

Kingston, Roland Frederick, M.R.C.S. (England), L.R.C.P. (London), 1940, 353, Edgecliff Road, Edgecliff.

Morris, Thomas, M.B., B.S., 1940 (Univ. Melbourne), 60, New Canterbury Road, Petersham.

Rudd, George Vincent, M.B., B.S., 1939 (Univ. Melbourne), 70, Phillip Street, Sydney.

Hains, Robert Myer, M.B., B.S., 1940 (Univ. Adelaide), 536, William Street, Broken Hill, New South Wales.

Nominations and Elections.

THE undermentioned have applied for election as members of the New South Wales Branch of the British Medical Association:

Grant, John Macdonald Falconer, M.B., B.S., 1945 (Univ. Sydney), 127, Ashley Street, Chatswood.

Karmalsky, Hillary, provisional registration, 1946 (Univ. Sydney), Adelong, New South Wales.

Gilles, Nancy Catherine, M.B., B.S., 1945 (Univ. Sydney), 24, Albermarle Avenue, Rose Bay.

Moss, John Timothy St. Leger, M.B., 1945 (Univ. Sydney), 189, Homer Street, Earlwood, New South Wales.

THE FEDERAL MEDICAL WAR RELIEF FUND.

THE following contributions to the Federal Medical War Relief Fund have been received:

South Australia.

Dr. S. R. Burston, £26 5s.
Dr. M. Mocatta, £25.
Dr. F. L. Thyer, Dr. A. Britten Jones, Dr. S. J. Douglas, Dr. W. W. Jolly, Dr. D. K. McKenzie, £10 10s.
Dr. E. L. Symons, Dr. C. F. Drew, Dr. E. J. Swann, £10.
Dr. G. Brown and Dr. M. Brown (joint contribution), Dr. J. E. Batemen, Dr. E. Brown Dr. O. W. Frewin, £5 5s.
Dr. N. S. Gunning, Dr. E. C. Black, £5.
Dr. A. S. de B. Cocks, Dr. D. G. Postle, £1 1s.
Dr. H. G. Prest, £1 0s. 6d.
Total: £167 17s. 6d.
Grand total: £6,667 0s. 3d.

Medical Appointments.

Dr. A. P. Cheery, Dr. F. A. Dibden, Dr. J. Fairley, Dr. K. D. Krantz, Dr. A. H. Margarey and Dr. I. L. Miller have been appointed resident medical officers of the Royal Adelaide Hospital, Adelaide.

Dr. Lindsay Dey has been appointed president of the Royal Alexandra Hospital for Children, Camperdown, New South Wales.

Diary for the Month.

MAY 7.—New South Wales Branch, B.M.A.: Organization and Science Committee.
MAY 10.—Queensland Branch, B.M.A.: Council Meeting.
MAY 14.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
MAY 14.—Tasmanian Branch, B.M.A.: Ordinary Meeting.
MAY 15.—Western Australian Branch, B.M.A.: General Meeting.
MAY 16.—Victorian Branch, B.M.A.: Executive Meeting.
MAY 16.—South Australian Branch, B.M.A.: Council Meeting.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Honorary Secretary, 135, Macquarie Street, Sydney): Australian Natives' Association; Ashfield and District United Friendly Societies' Dispensary; Balmain United Friendly Societies' Dispensary; Leichhardt and Petersham United Friendly Societies' Dispensary; Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney; North Sydney Friendly Societies' Dispensary Limited; People's Prudential Assurance Company Limited; Phœnix Mutual Provident Society.

Victorian Branch (Honorary Secretary, Medical Society Hall, East Melbourne): Associated Medical Services Limited; all Institutes or Medical Dispensaries; Australian Prudential Association, Proprietary, Limited; Federated Mutual Medical Benefit Society; Mutual National Provident Club; National Provident Association; Hospital or other appointments outside Victoria.

Queensland Branch (Honorary Secretary, B.M.A. House, 225, Wickham Terrace, Brisbane, B.17): Brisbane Associated Friendly Societies' Medical Institute; Bundaberg Medical Institute. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL or position outside Australia are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.

South Australian Branch (Honorary Secretary, 178, North Terrace, Adelaide): All Lodge appointments in South Australia; all Contract Practice appointments in South Australia.

Western Australian Branch (Honorary Secretary, 205, Saint George's Terrace, Perth): Wiluna Hospital; all Contract Practice appointments in Western Australia. All government appointments with the exception of those of the Department of Public Health.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

All communications should be addressed to the Editor, THE MEDICAL JOURNAL OF AUSTRALIA, The Printing House, Seamer Street, Glebe, New South Wales. (Telephones: MW 2651-2).

Members and subscribers are requested to notify the Manager, THE MEDICAL JOURNAL OF AUSTRALIA, Seamer Street, Glebe, New South Wales, without delay, of any irregularity in the delivery of this journal. The management cannot accept any responsibility or recognize any claim arising out of non-receipt of journals unless such a notification is received within one month.

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